June 2015

Tacoma Link Expansion

Environmental Evaluation

TRANSPORTATION TECHNICAL REPORT

SOUNDTRANSIT
Central Puget Sound
Regional Transit Authority

U.S. Department of Transportation
Federal Transit Administration

Tacoma Link Expansion

Transportation Technical Report

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Sound Transit

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A Signal Controller Data

B *Tacoma Link Expansion Transportation Technical Analysis Methodology Report*

C Transit Integration Plan

D Traffic Operational Measures of Effectiveness

Acronyms and Abbreviations

ADA	American with Disabilities Act
AWSC	all-way stop control
EB	eastbound
FGTS	Freight Goods Transportation System
HCM	Highway Capacity Manual
I-5	Interstate 5
I-705	Interstate 705
IC	Intercity Transit
LOS	level of service
MEV	million entering vehicles
MLK Jr. Way	Martin Luther King Junior Way
MOE	measures of effectiveness
mph	miles per hour
N/A	not applicable
NB	northbound
OCH	Old City Hall
OMF	operations and maintenance facility
OWSC	one-way stop control
PSRC	Puget Sound Regional Council
PT	Pierce Transit
SB	southbound
SR	State Route
ST	Sound Transit
TLE	Tacoma Link Expansion
TSP	transit signal priority
v/c	volume capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled
WB	westbound

1.0 Introduction

The Tacoma Link Expansion (TLE) project consists of constructing and operating a 2.4-mile urban rail system, including six new stations that would connect to the existing Tacoma Link system at the Theater District Station. On February 27, 2014, the Sound Transit Board of Directors identified the alignment for the TLE project. The TLE would improve access and mobility in the regional transit system by connecting Tacoma's Central Business District to the Hilltop Business District and four major hospitals and medical centers. The project would also provide economic development opportunities by connecting the existing Tacoma Link system with Tacoma's major activity centers and destinations within the city. Exhibit 1-1 presents a map of the existing alignment and proposed TLE. The project is a partnership between Sound Transit, the City of Tacoma, and the Federal Transit Administration.

TACOMA LINK EXPANSION

TACOMA LINK RAIL SYSTEM AND LOCATION

EXHIBIT 1-1

LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Parks
- Existing Operations and Maintenance Facility Site
- Proposed Operations and Maintenance Facility Expansion Site

0 0.125 0.25 0.5 Miles

SOUNDTRANSIT RIDE THE WAVE

2.0 Transportation Elements and Study Area

The transportation system analysis considered a number of transportation elements, including regional facilities, transit operations, arterial and local street operations and safety, parking, nonmotorized facilities, freight mobility and access, construction, and indirect and secondary impacts. This technical report discusses each transportation element individually and covers the affected environment for the existing year (2014) and the expected environmental impacts for the horizon year (2035), comparing the No Build Alternative to the TLE Build Alternative, including potential mitigation. The findings presented in this report are based upon the conceptual engineering plans.

The primary study area for this transportation analysis includes the proposed alignment and surrounding roadways located in the North Downtown and Hilltop Subareas in Tacoma, Washington. The existing Tacoma Link system was also analyzed to assess changes in station ridership with the TLE.

Twenty-two intersections were identified for study as part of the transportation analysis. All fourteen signalized intersections along the alignment were analyzed to identify potential operational concerns. Eight unsignalized intersections were also identified for analysis due to their proximity to stations, proposed change to intersection control due to the project, or the potential for poor operations. For nonmotorized and parking facilities, a fixed buffer was defined for analysis purposes. Specific study areas vary by transportation element and are described in the relevant sections. Exhibit 2-1 shows the overall transportation study area and other key transportation study elements.

For this report, the transportation study area is divided into three subareas to better describe roadway and transit characteristics, measures of effectiveness (MOE), and potential mitigation. The subareas include the alignment and generally one to two adjacent streets on either side of the alignment. Each subarea is briefly described below and is also illustrated in Exhibit 2-1.

- **North Downtown/Stadium District** extends from the Commerce Street/9th Street and continues north along Stadium Way and N 1st Street until Division Avenue. The subarea includes a mix of central business district land uses, dense residential, and commercial. Three stations (two new and one relocated) are included in this subarea.
- **Division/North MLK** continues west from the N 1st Street/Division Avenue intersection to Martin Luther King Jr. Way (MLK Jr. Way) where it extends south to S 9th Street. A mix of commercial, single-family residential, and healthcare-related land uses are contained in the subarea. Two new stations are proposed within the subarea.
- **South MLK** extends from S 9th Street to S 20th Street along MLK Jr. Way. A vibrant mix of commercial developments are along MLK, while mostly single-family residential land uses are on adjacent north-south roads. Between S 17th and 19th Streets, healthcare-related land uses are present in the eastern portion of the subarea. Two new stations are proposed within the subarea.

TACOMA LINK EXPANSION

TRANSPORTATION ANALYSIS STUDY AREA

EXHIBIT 2-1

LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Existing Operations and Maintenance Facility Site
- Proposed Operations and Maintenance Facility Expansion Site
- Intersections
- Subarea Boundaries

0 0.125 0.25 0.5 Miles

SOUNDTRANSIT RIDE THE WAVE

2.1 Alignment and Stop Locations

The TLE alignment is approximately 2.4 miles long and, it extends north from the 9th Street/Theater District Station via Stadium Way to MLK Jr. Way at S 19th Street. There are six new proposed stations on the alignment, to be located near the following:

- Stadium Way and S 4th Street
- Stadium District
- MLK Jr. Way and Division Avenue
- MLK Jr. Way and 6th Avenue
- MLK Jr. Way and S 11th Street
- MLK Jr. Way and S 19th Street

In addition, one station (Theater District) would be relocated in the median, in front of the Old City Hall Building. The alignment terminus is located north of the MLK Jr. Way/S 19th Street intersection. The project directly connects to the existing Tacoma Link system. The TLE project also expands the existing Operations and Maintenance Facility (OMF). The additional Tacoma Link vehicles would require additional storage and track space. Expanding the OMF would occur on property adjacent to the existing OMF and also would require property acquisition.

2.2 Platforms

Station platforms are at the locations described above and serve both inbound (traveling to the Tacoma Dome Station) and outbound (traveling away from the Tacoma Dome Station) Tacoma Link vehicles. Two types of station platforms are used—curbside and median. Table 2-1 lists each station and platform type proposed.

TABLE 2-1
Proposed Tacoma Link Expansion Stations and Platform Types

Station Location	Direction [a]	Platform Type	Stop Type
Commerce Street/S 7th Street	Inbound	Median	Nearside
	Outbound	Median	Farside
Stadium Way/4th Street	Inbound	Median	Nearside
	Outbound	Median	Farside
N 1st Street/N Tacoma Avenue	Inbound	Curbside	Nearside
	Outbound	Curbside	Farside
MLK Jr. Way/S 3rd Street	Inbound	Curbside	Nearside
	Outbound	Curbside	Nearside
MLK Jr. Way/6th Avenue	Inbound	Curbside	Nearside
	Outbound	Curbside	Nearside
MLK Jr. Way/S 11th Street	Inbound	Curbside	Nearside
	Outbound	Curbside	Nearside
MLK Jr. Way/S 18th Street	Both	Median	N/A[b]

Notes:
[a] Inbound = toward Tacoma Dome Station; outbound = away from Tacoma Dome Station.
[b] N/A = not applicable; station platform to be located in exclusive right–of-way in median on MLK Jr. Way.

Curbside platforms extend out from the sidewalk and curb to serve a single direction of travel. They might replace on-street parking, existing transit stops, or loading zones; typically up to four parallel parking spaces might be removed, depending on specific site conditions. Existing curbs are reconstructed to blend into the new platform area.

Median platforms occupy the center of the roadway and would serve both directions of travel from a single platform. A median platform might replace an existing center-turn lane and might restrict left-turn movements across the roadway into driveways. With the most current TLE conceptual design, no turning movements would be restricted at intersections. During preliminary engineering, turn restrictions may be recommended as needed. In general for median stations, the platform would require some reconstruction of the asphalt roadway near the platform to restore the surface back to usable condition. Access to median platforms is provided via crosswalks located at adjacent intersections or midblock crossings.

Each platform has a boarding area approximately equal to the length of one Tacoma Link vehicle, approximately 66 feet long. Ramps and curbs transition the boarding area back to the sidewalk or pavement; therefore, each station occupies a footprint of approximately 90 feet long. Curbside platforms are 8 feet wide, and median platforms are 12 feet wide. Each platform is Americans with Disabilities Act (ADA)-accessible from either the sidewalk or crosswalk and has level boarding with the Tacoma Link vehicle's low-floor section. Seating, signage, canopy shelter, fare collection equipment, and public art would be constructed at each platform.

New curb ramps would provide ADA accessibility to the Tacoma Link system at all four corners of intersections where new stations are proposed, at intersections on the Tacoma Link alignment, and at locations where the project would overlay asphalt. New curb ramps would also be constructed at all four corners of intersections where Tacoma Link vehicle tracks make tight turns that encroach into the existing curb. Driveways and sidewalks would be reconstructed in areas where it is necessary to accommodate tracks and/or station platform ramps and curbs.

2.3 Track and Roadway Cross-Section

The Tacoma Link alignment would be constructed within the existing roadway right-of-way and would generally allow mixed-flow operation of the Tacoma Link vehicles and other vehicles. Two segments of track would be located in an exclusive transit right-of-way. The inbound vehicle along Division Avenue from MLK Jr. Way to N "I" Street and the tail track segment at the project terminus near MLK Jr. Way/S 19th Street would be located in an exclusive right-of-way, removing the existing center-turn lane and a portion of the southbound left turn pocket at MLK Jr. Way/S 19th Street.

Tracks would be in the travel lanes on each side of the roadway. The tracks would be constructed with an 8-foot-wide concrete slab, approximately 14 inches deep, with two "tee" rails encased in a rubber boot and embedded in the concrete. The surface would have a notch, or flangeway, on each side of the rail to accommodate the rail vehicle wheel flange. The flangeway would be "U" shaped and formed by installing a rubber insert next to the rail. The track slab would be flush with the top of the roadway surface. The existing roadway asphalt surface would be removed in the area of the track slab, plus

approximately 2 feet beyond each track slab edge, to allow a smooth transition between the edge of slab and the asphalt surface. In areas where two track slabs are placed closely to each other, the area of pavement in between would be reconstructed if it is less than 4 feet in width. The extent of roadway reconstruction would be defined in more detail during preliminary and final engineering.

The project includes a mill and overlay of the roadway surface from curb to curb and restriping of the roadway. The restriping is designed to allow for safe passage and clearance of the Tacoma Link vehicle travel lanes adjacent to other parking, bicycle, and vehicle lanes. New traffic warning and regulatory signs would be placed along the alignment to provide safety and information to drivers, bicyclists, and pedestrians.

The project's design philosophy is to blend into the normal traffic stream as practicably and safely as possible. Existing turn lanes, parking lanes, loading zones, bus stops, bicycle lanes, and sidewalks would mostly remain as they exist today, with exceptions at stations and other areas where revisions are necessary to facilitate safe crossings and movements. Best design practices would be used to minimize impacts to other travel modes (bicycle, pedestrian, automobile, and rubber tire transit).

2.4 Traffic Signals and Transit Signal Priority

At signalized intersections, the Tacoma Link vehicle operates like other vehicles in the roadway, following normal traffic signal indications and remaining part of the traffic flow. Some intersections require special phasing or signaling for the Tacoma Link vehicle to traverse the intersection safely and to minimize Tacoma Link vehicle delays. These phase insertions only occur when a Tacoma Link vehicle is detected and requests priority for this phase. The design criteria manual developed for the TLE outlines needed traffic control for the safe and efficient operation of the Tacoma Link vehicles. Table 2-2 shows study intersections that have proposed intersection control and/or phasing changes.

Signals might also be modified at station locations to turn the signal red after a Tacoma Link vehicle passes through to prevent vehicle queues from forming behind the Tacoma Link vehicle and blocking the upstream intersection. This provision is recommended where farside stops are close to signalized intersections, in particular at the Stadium Way/4th Street signal.

Along MLK Jr. Way, traffic signals are proposed to be upgraded from pretimed operations to an actuated and coordinated system to better facilitate Tacoma Link vehicle operations. Signal-controller upgrades and pedestrian push buttons would be provided at applicable signalized intersections along the alignment. Several signal controllers may need to be upgraded to accommodate the Tacoma Link vehicle operation. Appendix A provides a list of the traffic signals in the study area, including the type, control, and communication links available at each location.

TABLE 2-2
Proposed Tacoma Link Expansion Study Intersection Control and Phasing Modifications

Intersection	Control Change	Phase Insertion	Description
Commerce Street/ 9th Avenue	None	Add protected southbound left/through phase on Commerce Street	Signal would be modified to provide a protected southbound left/through phase on Commerce Street to clear traffic in front of inbound Tacoma Link vehicle. Existing inbound exclusive transit phase would be removed. No change to outbound Tacoma Link vehicle phase.
Commerce Street/ 7th Street	Convert AWSC to OWSC	None	Stop signs would be removed for Commerce Street approaches.
N 1st Street/ Division Avenue	None	Add protected left-turn phase on eastbound Division Avenue	Protected left-turn phase provided from Division Street to N Yakima Avenue.
N "I" Street/ Division Avenue	None	Add Tacoma Link vehicle-only phase	Tacoma Link vehicle-only phase would be provided to allow inbound Tacoma Link vehicle to move from an exclusive right-of-way to mixed-flow operation.
MLK Jr. Way/ Division Avenue	None	Add protected westbound left-turn phase on Division Avenue	Protected westbound left-turn phase on Division Avenue would be provided to clear traffic in front of outbound Tacoma Link vehicle.
MLK Jr. Way/ S 17th Street	Provide signal	Add Tacoma Link vehicle-only phase	New signal would be provided to protect inbound Tacoma Link vehicle as it moves into mixed-flow traffic stream.
MLK Jr. Way/ S 18th Street	Provide signal	Add protected southbound left/through phase on MLK Jr. Way	Signal provided to mitigate sight distance issues when Tacoma Link vehicle is laying over in tail track segment.

Notes:
Inbound = to Tacoma Dome Station
Outbound = away from Tacoma Dome Station
AWSC = all-way stop control
OWSC = one-way stop control

Transit signal priority (TSP) is assumed at all signalized intersections along the Tacoma Link alignment. TSP provides transit vehicles extra green time (green extension) or less red time (red truncation) at traffic signals by taking time from other traffic movements without breaking signal coordination. This is different from signal preemption, which immediately serves a transit vehicle and drops signal coordination. Sound Transit currently operates an aggressive level of TSP on their existing system. For the future TLE, the level of TSP at intersections would be agreed upon by the City of Tacoma and Sound Transit and modified once the TLE is operating to balance the mobility needs of the Tacoma Link vehicles and other transportation modes. TSP would continue to be analyzed during preliminary engineering and final design. TSP and other signal revisions are part of the project's capital cost and constructed with the project.

Transit Signal Priority vs Transit Preemption

Transit signal priority is the preferential treatment of a transit vehicle (such as a Tacoma Link vehicle) over another vehicle at a signalized intersection without causing the traffic signal controllers to drop from coordinated operations. Priority is provided by extending green time, shortening red times, phase switching (rotation), or omitting vehicle/pedestrian phases.

Transit preemption is the transfer of the normal control (operation) of traffic signals to a special signal control mode to service mass transit vehicle passage, the control of which requires terminating normal traffic control to provide priority service.

2.5 Tacoma Link Operations

The TLE is expected to operate about 17 hours per day (from 5:00 a.m. to 10:00 p.m.), offering service every 10 minutes during peak periods and every 20 minutes during off-peak periods. Vehicles are expected to have a passenger capacity of approximately 30 seated and 60 standing passengers.

The project would add five new vehicles to the Tacoma Link system. The project's alignment, stations, and vehicles would be compatible with the existing system so that both old and new vehicles can traverse the entire system from end to end. The new vehicles would have similar characteristics to the existing fleet, including the following:

- Bidirectional
- Low-floor and near-level boarding
- Double-articulated
- ADA-accessible with bridge plate

3.0 Methodology and Assumptions

The methodology and assumptions used to analyze the transportation impacts of the TLE have been compiled in the *Tacoma Link Expansion Transportation Technical Analysis Methodology Report* (Sound Transit, 2014a), which is provided in Appendix B of this technical report. That report presents the following information:

- Agency guidelines and regulations regarding the transportation analysis
- Data collected and sources, such as traffic volumes, parking supply and utilization, pedestrian and bicycle facilities, crash data, and transit service characteristics
- Transportation analysis methodology, including relevant definitions and procedures for regional traffic analysis, transit operations, local and arterial traffic analysis, intersection operational analysis, and safety assessments
- Methods for traffic forecasting and transit ridership estimates
- Methods for assessing impacts related to Tacoma Link station areas, parking, nonmotorized facilities and modes, freight, transit, and construction.

The transportation impacts of the TLE were analyzed from three different perspectives: regional, screenline (corridor), and local operations. The regional and screenline assessments studied larger areas of the transportation study area. The operational assessment identified and analyzed specific roadways and intersections. The following types of information were developed and evaluated:

- Regional analysis, such as projectwide ridership, daily vehicles miles traveled (VMT), and vehicle hours traveled (VHT)
- Screenline analysis of transit service and ridership, roadway volumes, volume/capacity (v/c) ratio, and mode share
- Operational analysis, which includes an analysis of the level of service (LOS) and safety of arterial and local streets
- Impacts on parking in terms of any removal, replacement, or addition
- Impacts on nonmotorized facilities, which includes pedestrian and bicycle access to the study intersections and potential station locations
- Transit operations, which includes service coverage and circulation
- Impacts on freight movement
- Any indirect impacts on transportation system caused by changes in travel patterns with the project; any potential mitigation measures required to meet jurisdictional standards
- Any cumulative impacts on the transportation system and impacts during construction period

4.0 Affected Environment

The affected environment for transportation, described in this section, includes existing conditions for all transportation system components in the study area. This section describes the traffic-related operations and performance on all roadway facilities, transit (road-based and rail), parking, bicycles, pedestrians, and freight. This section also describes the safety conditions on the roadways and at intersections in the study area.

4.1 Regional Facilities and Travel

Regional facilities in the TLE study area are served by two major highway facilities, Interstate 705 (I-705) running north-south and State Route (SR) 509 running east-west. Arterial roadways such as MLK Jr. Way, S Yakima Avenue, and Pacific Avenue are the main north-south connections to SR 509 or Interstate 5 (I-5). These arterials provide connections within the study area and to/from areas south of the project.

4.1.1 Vehicle Miles Traveled and Vehicle Hours Traveled

Today, more than 85 million VMT occur daily within the central Puget Sound Region (which includes King, Kitsap, Pierce, and Snohomish Counties). This results in more than 2.5 million VHT daily for all users of the transportation system.

4.1.2 Screenline Performance

Five screenlines, which cut across I-705 and major arterial roadways, were established to assess the travel patterns within the study area. These screenlines, as shown in Exhibit 4-1, provide a snapshot of regional traffic operations, such as volumes and travel mode share, based on the travel demand estimated from the Puget Sound Regional Council (PSRC) and Sound Transit regional models.

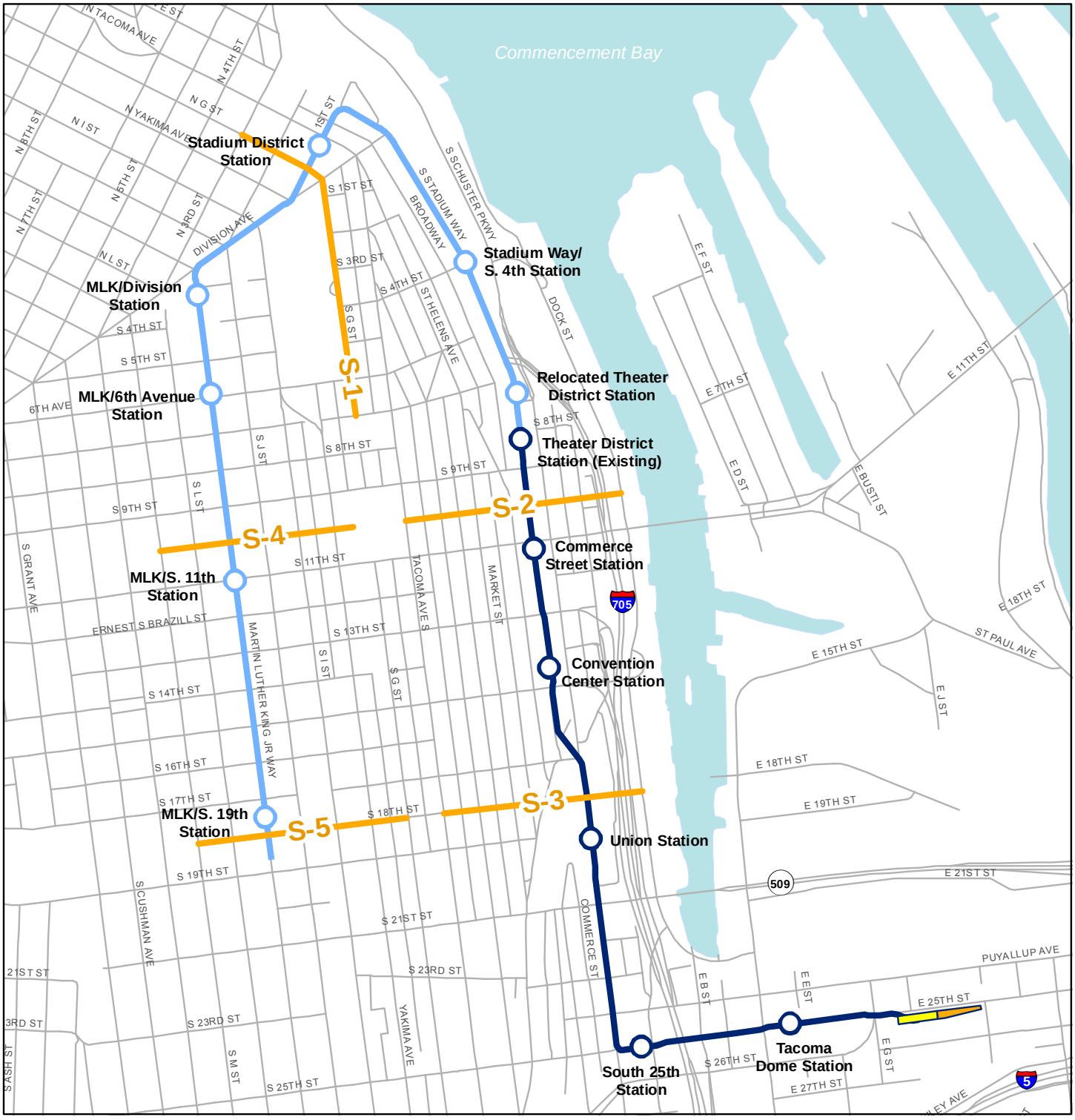
Volume to capacity (v/c) ratios were used as the performance measure to assess travel conditions on regional facilities in the study area. Screenline v/c ratios were used to show how much capacity is available on multiple adjacent roads crossing the screenline. This type of analysis was used in conjunction with more detailed intersection capacity measures (described further in Section 4.3.2). Capacity deficiencies might exist when a v/c ratio exceeds 0.9. A v/c ratio more than 1.0 suggests that demand exceeds capacity and congestion is likely which prohibits the efficient movement of people and goods. Mode share information allocates the vehicle demand on a roadway by vehicular type, which includes automobile vehicles and transit.

Table 4-1 shows the performance at screenlines for the existing PM peak-hour conditions. In general, existing facilities are under capacity. Transit mode share at the five screenlines varies between 1 and 9 percent. Overall, the automobile mode is the dominant mode, with more than 90 percent usage.

TACOMA LINK EXPANSION

SCREENLINES

EXHIBIT 4-1



LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Screenlines

0 0.125 0.25 0.5 Miles

SOUNDTRANSIT
RIDE THE WAVE

TABLE 4-1
Existing PM Peak-Hour and Daily Screenline Performance

Screenline Location	Direction	Vehicle Volume	Volume/ Capacity Ratio	Persons	Person Mode Share		Daily Vehicle Volume
					Automobile	Transit	
Screenline S-1—G Street between S 3rd Street and S 7th Street	EB	950	0.28	1,250	91%	9%	10,400
	WB	1,050	0.31	1,350	92%	8%	12,400
Screenline S-2—S 10th Street between Dock Street and S Tacoma Avenue	NB	3,150	0.31	3,950	96%	4%	32,600
	SB	3,050	0.31	3,800	96%	4%	35,600
Screenline S-3— S 18th Street between Dock Street and S Tacoma Avenue	NB	4,300	0.30	5,500	94%	6%	52,600
	SB	5,650	0.53	7,200	94%	6%	58,000
Screenline S-4— S 10th Street between S Tacoma Avenue and M Street	NB	800	0.22	1,000	99%	1%	8,300
	SB	650	0.17	800	99%	1%	7,300
Screenline S-5— S 18th Street between S Tacoma Avenue and M Street	NB	750	0.20	900	98%	2%	10,600
	SB	1,300	0.35	1,550	99%	1%	11,800

Notes:
Source: Sound Transit, 2012; Pierce County, 2011.
EB = eastbound
NB = northbound
SB = southbound
WB = westbound

4.2 Transit Service and Operations

4.2.1 Transit Service and Facilities

Three transit agencies provide service in the study area: Pierce Transit, Sound Transit, and Intercity Transit. Pierce Transit provides local service, while Sound Transit and Intercity Transit provide regional and multicity service. Bus service in the city of Tacoma is principally radial, meaning that service is focused on downtown with most routes originating and terminating in the central business district. Some crosstown service is available. A total of 23 bus routes serve the study area, shown in Exhibit 4-2.

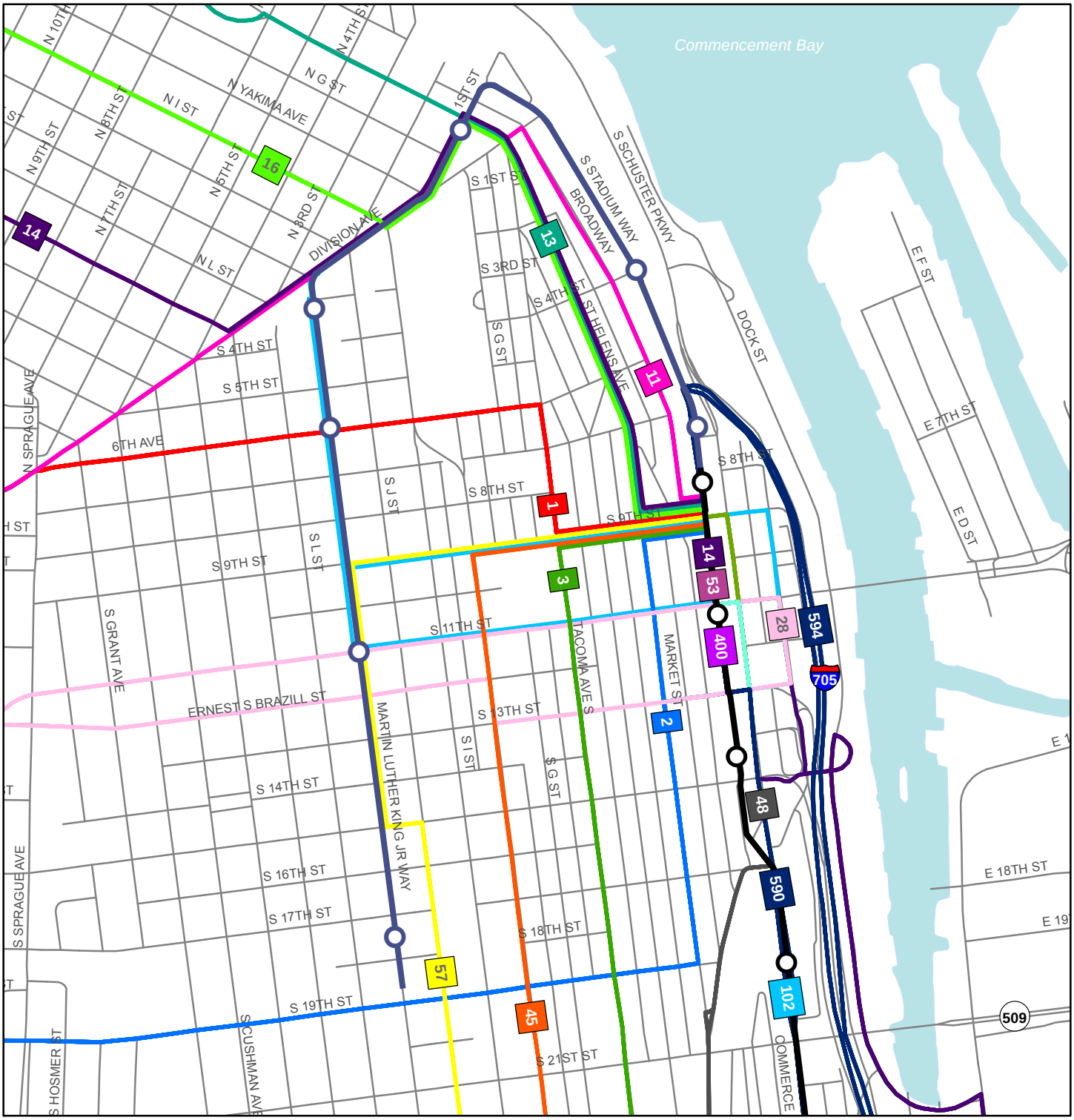
Three Pierce Transit "trunk" routes—Route 1, Route 2, and Route 3—generally provide 15- to 30-minute peak and off-peak service, while other routes through the study area generally provide 30- to 60-minute peak and off-peak service. Table 4-2 describes the basic operating characteristics of the local, regional, and express bus routes serving the transportation study area.

The study area is served by one major transit center in the study area: the Commerce Street Transit Center. This facility is located along Commerce Street between 9th and 11th Streets, and it primarily serves Pierce Transit routes; however, both Sound Transit Express buses and Intercity Transit buses stop at this location. Southeast of the study area, the Tacoma Dome Station is the southern terminus of the existing Tacoma Link system. The station offers connections between Pierce Transit routes and regional transit (Sounder Commuter Rail and Sound Transit Express buses) and inter-city transit (Greyhound Bus Lines and Amtrak).

TACOMA LINK EXPANSION

EXISTING TRANSIT ROUTES AND SERVICE

EXHIBIT 4-2



Legend

- Existing Stations
- ProposedStations
- Existing Alignment
- Proposed Alignment
- Existing Transit Routes

0 0.1 0.2 0.4 Miles

Note: Some routes are overlaid on top of other routes; therefore not all routes are visible.

Source: Sound Transit, 2014b; Pierce Transit, 2014; Intercity Transit, 2014

Date: 12/23/2014

SOUNDTRANSIT RIDE THE WAVE

TABLE 4-2
Existing Transit Services in Tacoma Link Expansion Transportation Study Area

Route	Service Period [a]	Peak Headway (minutes)	Off-Peak Headway (minutes)	Service Area
PT 1	Daily	15	20	Tacoma Community College, Downtown Tacoma, Parkland TC, Spanaway Airport, Walmart
PT 2	Daily	20	30	Downtown Tacoma, Bates Technical College, Tacoma Community College, University Place, Lakewood Towne Center
PT 3	Daily	30	30	Downtown Tacoma, Tacoma Mall, Lakewood Mall
PT 11	Peak/Off-Peak	60	60	Port Defiance Ferry, Proctor, University of Puget Sound, Downtown Tacoma, Tacoma General Hospital
PT 13	Peak/Off-Peak	60	60	Downtown Tacoma, Museum of Glass, Tacoma Dome Station
PT 14	Peak/Off-Peak	60	60	Proctor District, University of Puget Sound, Downtown Tacoma, Museum of Blass, Tacoma Dome Station
PT 16	Daily	60	60	Tacoma Community College, Proctor, Downtown Tacoma
PT 28	Daily	30	60	Tacoma Community College, Central Tacoma, Downtown Tacoma
PT 41	Daily	30	60	Downtown Tacoma, Tacoma Dome Station, McKinley Hill, 72nd St. Transit Center Portland Ave
PT 42	Peak/Off-Peak	60	60	Downtown Tacoma, Tacoma Art Museum, America's Car Museum, Tacoma Dome Station, Hillsdale, 72nd St. Transit Center
PT 45	Peak/Off-Peak	60	60	Downtown Tacoma, Parkland Transit Center
PT 48	Daily	30	60	Downtown Tacoma, Lakewood Mall Transit Center
PT 53	Peak/Off-Peak	60	60	Downtown Tacoma, Tacoma Mall Transit Center, University Place, Tacoma Community College
PT 57	Daily	30	30	Downtown Tacoma, Hilltop, St. Joseph Medical Center, Tacoma Mall
PT 102	Peak	30 to 60	-	Tacoma General Hospital, Downtown Tacoma, Tacoma Dome Station, Gig Harbor
PT 400	Peak/Off-Peak	30	60	Downtown Tacoma, Tacoma Dome Station, Puyallup, Washington State Fairgrounds, South Hill Mall Transit Center
PT 500	Daily	60	60	Downtown Tacoma, Fife, Federal Way
PT 501	Daily	60	60	Downtown Tacoma, Fife, Milton, Federal Way
ST 590/594	Daily	15 to 20	20 to 30	Downtown Tacoma, Lakewood, Seattle
IC 603	Daily	20 to 30	90	Tacoma, Lakewood, and Olympia
IC 605	Daily	20 to 30	90	Tacoma, Lacey, Lakewood, and Olympia
IC 612	Peak	N/A[b]	-	Tacoma and Lacey

Notes:
[a] Peak period is defined as from 6 to 9 a.m. and 3 to 7 p.m.; off-peak is defined as between 9 a.m. and 3 p.m.; and daily includes peak, off-peak, and service provided after 7 p.m.
[b] N/A = not applicable; service is provided once daily.
IC = Intercity Transit
PT = Pierce Transit
ST = Sound Transit
Sources: Pierce Transit, 2014; Sound Transit, 2014b; Intercity Transit, 2014.

4.2.2 Existing Tacoma Link Ridership

As shown in Table 4-3, Tacoma Link averaged approximately 3,600 boardings per day in 2012. The stations with the highest levels of passenger activity include the Tacoma Dome and Union Stations.

TABLE 4-3
Existing Tacoma Link Expansion Weekday Station Boardings

Station Area	Existing Conditions
Tacoma Dome	1,050
S 25th Street	380
Union Station	810
Convention Center	340
Commerce	570
Theater	420
Total Boardings for all Stations	3,570

Source: Sound Transit, 2012

4.3 Arterial and Local Street Operations and Safety

This section describes existing conditions for arterials and local roadway facilities, intersection operations, and traffic safety within the transportation study area.

4.3.1 Existing Roadways

Exhibit 2-1 shows the roadways in the study area, including major facilities. The main roads that would be served or affected by the TLE includes Commerce Street, S Stadium Way, N 1st Street, Division Avenue, and MLK Jr. Way. The characteristics of these roadways are described as follows:

- **Commerce Street** is a north-south, two-way minor arterial. The existing Tacoma Link runs along Commerce Street from S 17th Street to S 9th Street. The corridor has one travel lane in each direction and generally does not have a center turn lane or left-turn pockets at intersections. Commerce Street is classified as a transit priority street, not only serving the existing Tacoma Link light rail, but also several Pierce Transit, Sound Transit, and Intercity Transit bus routes. The Commerce Street Transit Center is located between S 9th and S 11th Streets and is served by Tacoma Link and most bus routes traversing downtown. The posted speed limit is 25 miles per hour (mph).
- **S Stadium Way** is a minor arterial that would connect the existing Tacoma Link from North Downtown Tacoma to the Stadium District. S Stadium Way has recently been improved, providing one lane in each direction and a center turn lane. Dedicated bicycle lanes are provided from the I-705 ramps to Tacoma Avenue. Minimal on-street parking is provided. The posted speed limit is 30 mph.
- **N 1st Street** is classified as a minor arterial and the City of Tacoma classifies it as a core pedestrian street (*North Downtown Tacoma Subarea Plan;* City of Tacoma, 2014a). Along the Tacoma Link

alignment, the road has one lane in each direction and does not have a center turn lane. Parallel on-street parking is provided on the west side of the road. In contrast, a combination of parallel and angle parking is provided along the east curb face. The corridor is currently served by several Pierce Transit bus routes. The posted speed limit is 30 mph.

- **Division Avenue** is a minor arterial between N 1st Street and MLK Jr. Way**.** The road has one to two lanes in each direction and a center turn lane. On-street parking is provided, except between N I Street and N 1st Avenue, where an extra travel lane is provided**.** Along the Tacoma Link alignment, grades in excess of 7 percent are present and the posted speed limit varies between 25 and 30 mph.
- **MLK Jr. Way** is identified as a collector arterial and as a core pedestrian street. The street provides access to the Hilltop neighborhood and is also the primary location of commercial activity in the neighborhood. The road has one lane in each direction, a center turn lane, and left turn pockets at most signalized intersections. Two major hospitals, Tacoma General Hospital and St. Joseph Medical Center, are located along MLK Jr. Way and have private vehicle emergency access to and from the road. On-street parallel parking is generally provided along both sides of the street, with a few exceptions near the two hospitals**.** The posted speed limit is 25 mph.

4.3.2 Intersection Operations and Level of Service

4.3.2.1 Intersection Traffic Volumes

PM peak-hour turning movement volumes and bicycle and pedestrian volumes were collected for all study intersections along the Tacoma Link alignment. Traffic volumes were reviewed and a system peak hour between 4:30 p.m. to 5:30 p.m. was identified. This peak hour was used in the analysis since it represents the worst-case period. The PM traffic volumes are shown in Exhibits 4-3 through 4-6.

4.3.2.2 Intersection Level of Service

Key intersections in the transportation study area were analyzed to understand their operating conditions. All identified intersections were analyzed for the PM peak hour. Intersections are considered failing when they do not operate at or better than the agency's intersection LOS standard. Failing LOS standards indicate that vehicles incur substantial delay and vehicle queuing is evident. As previously mentioned in Section 2.2, the Tacoma Link alignment would not restrict turning movements at intersections.

Table 4-4 lists the LOS standards, or lowest acceptable LOS threshold, for the City of Tacoma. The City of Tacoma has jurisdiction over all study intersections.

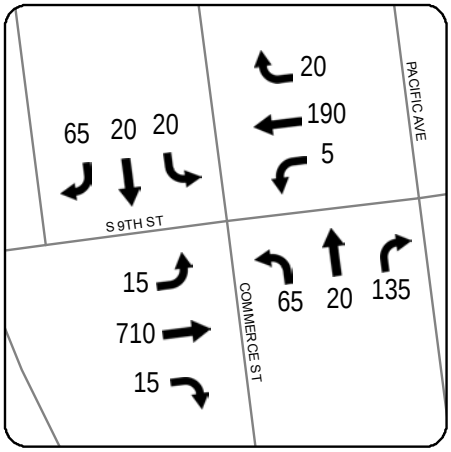
For this analysis, an intersection LOS E was the guiding LOS standard. The City of Tacoma recently adopted the *North Downtown Subarea Plan* (City of Tacoma, 2014a) and *Hilltop Subarea Plan* (City of Tacoma, 2014b), which indicate a standard of LOS E. All study intersections are within either the North Downtown or the Hilltop subarea. For the TLE transit vehicle, the goal was also to maintain a minimum average delay equivalent to or less than the vehicle delay associated with LOS D.

TACOMA LINK EXPANSION

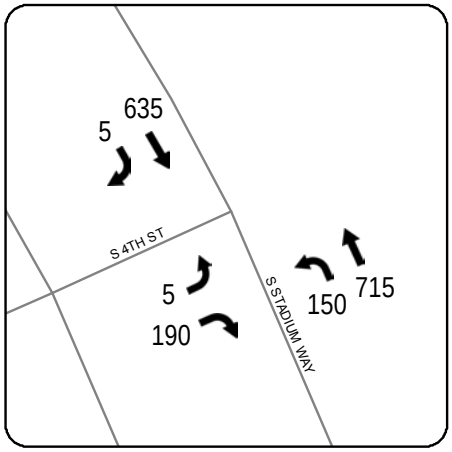
EXISTING PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 4-3

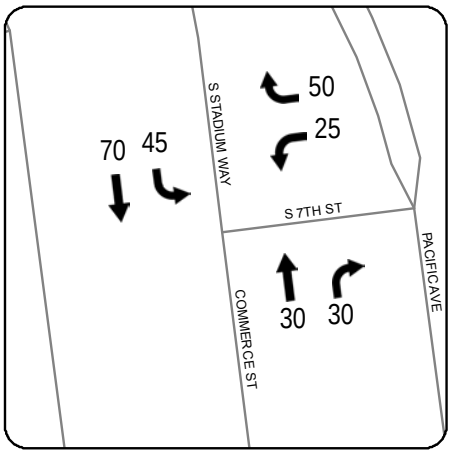
1 Commerce St & S 9th St



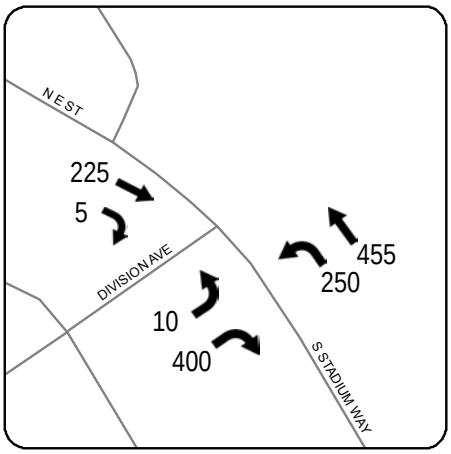
4 S Stadium Way & S 4th St



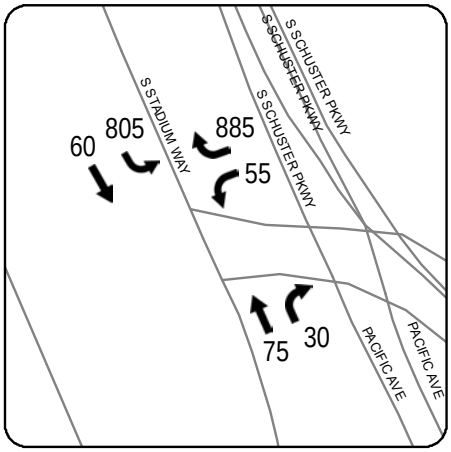
2 Commerce Ave & S 7th St

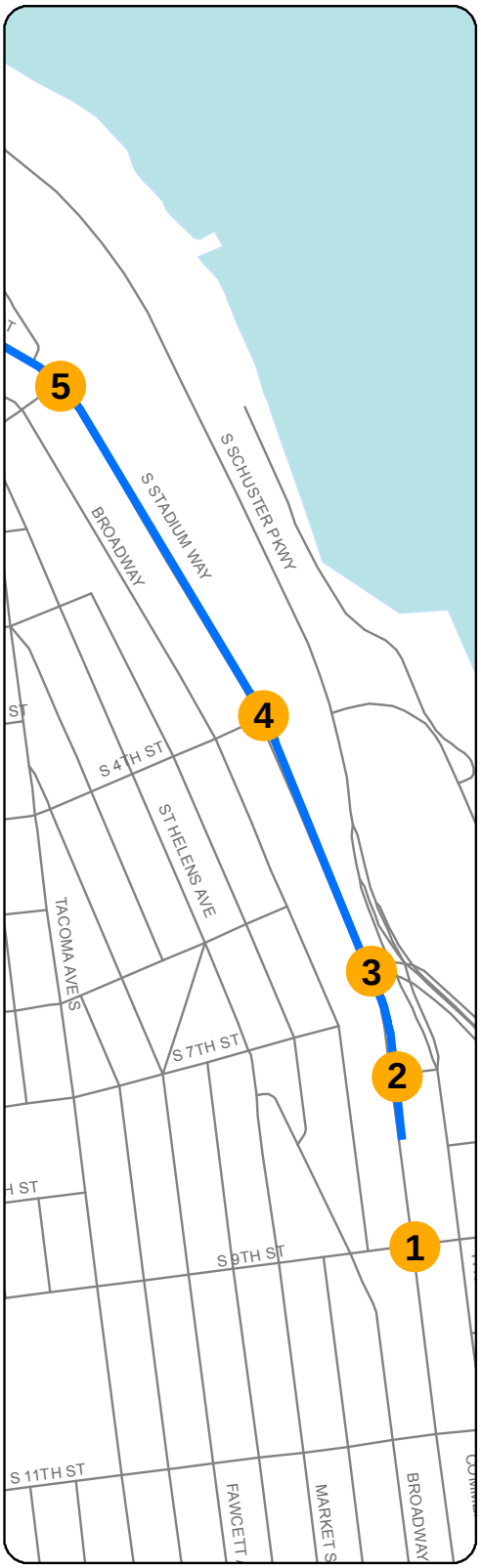


5 S Stadium Way & Division Ave



3 S Stadium Way & I-705 Ramps





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 375 750 1,500 Feet

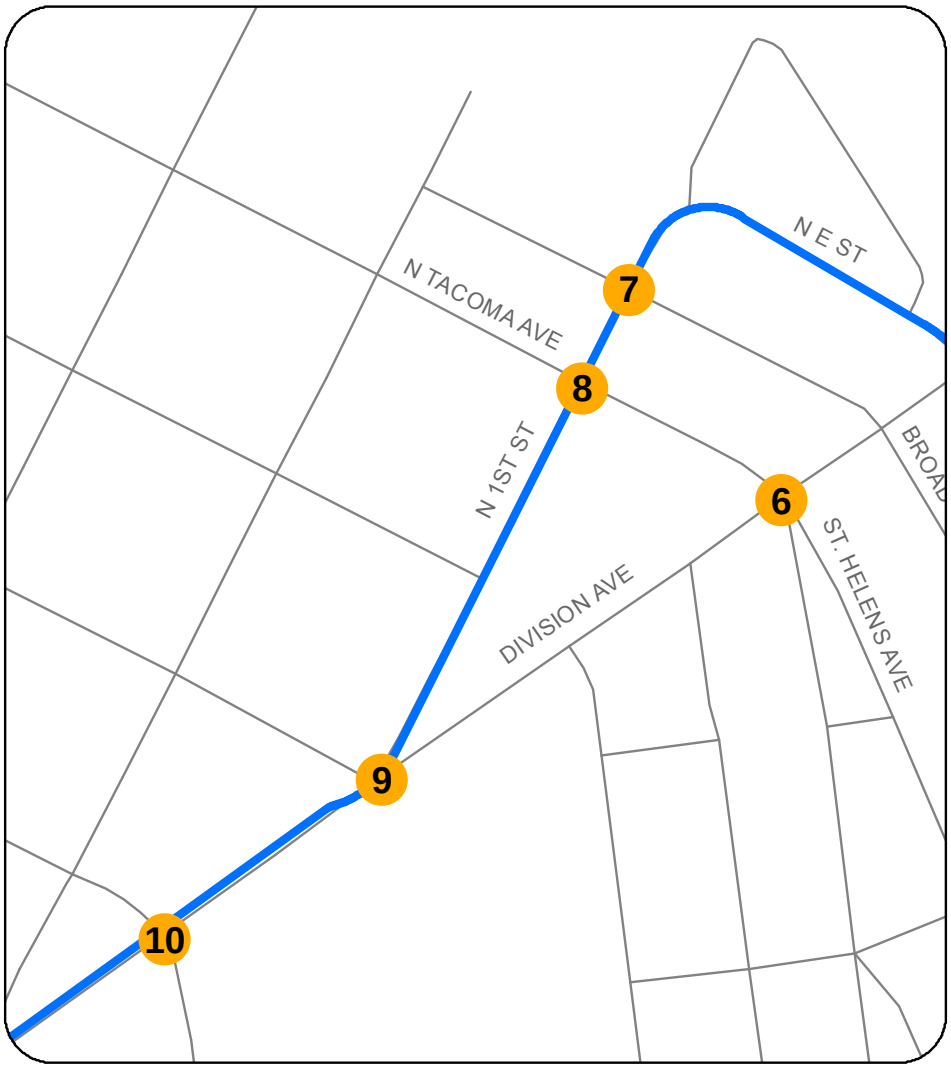
Data Source:
CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

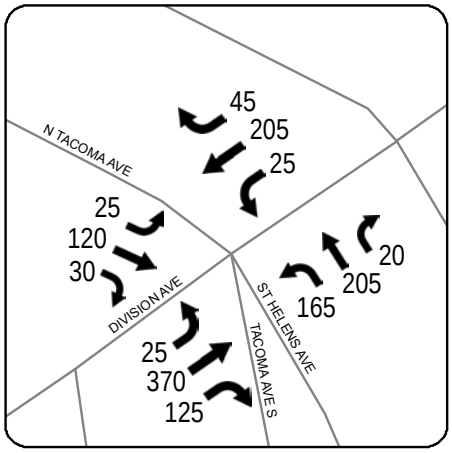
TACOMA LINK EXPANSION

EXISTING PM PEAK HOUR TRAFFIC VOLUMES

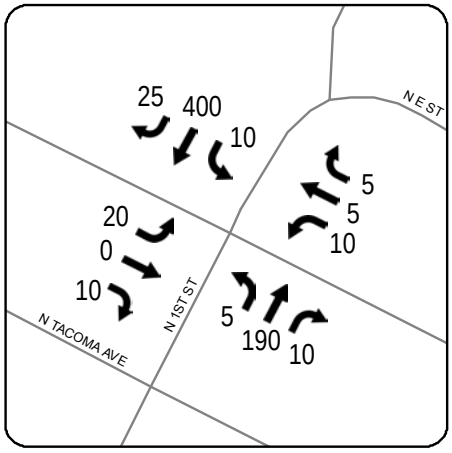
EXHIBIT 4-4



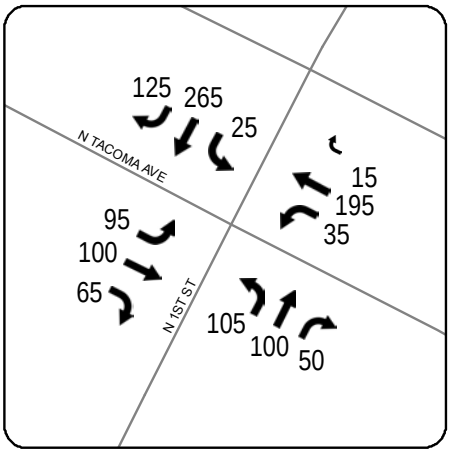
6 Division Ave & N Tacoma Ave



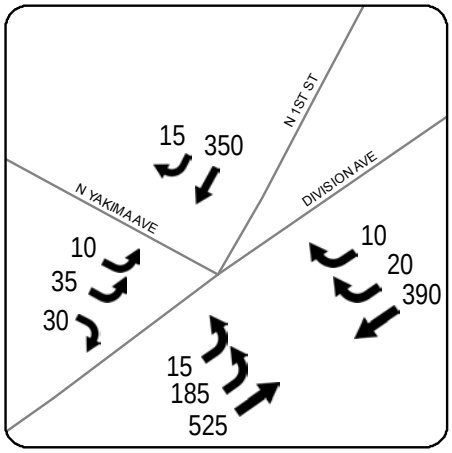
7 N 1st St & N Broadway St



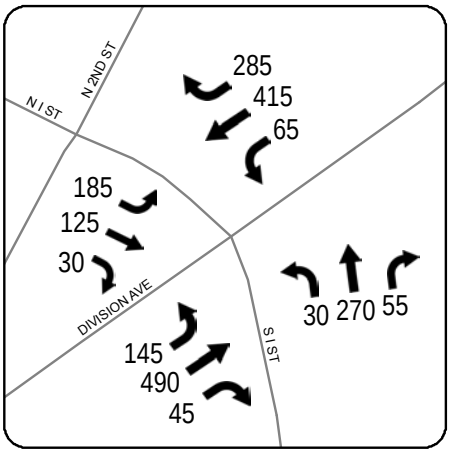
8 N 1st St & N Tacoma Ave



9 Division Ave & N 1st St



10 Division Ave & I (Eye) St



LEGEND

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 100 200 400 Feet

Data Source:
CH2M HILL (2014)

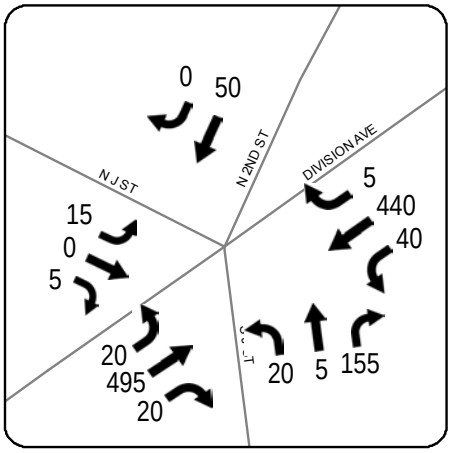
SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

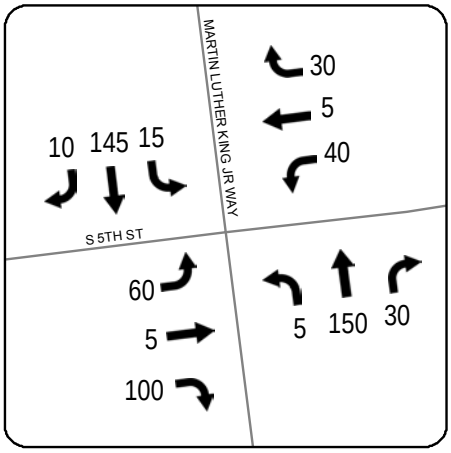
EXISTING PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 4-5

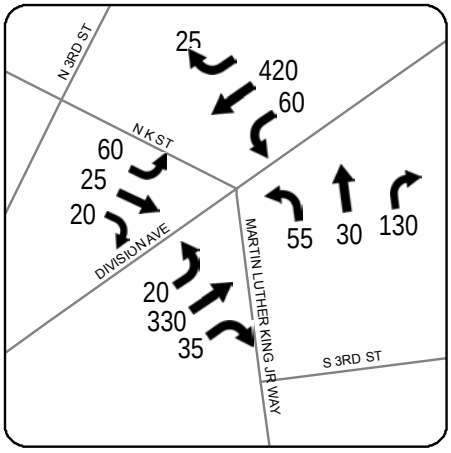
11 Division Ave & N J St/N 2nd St



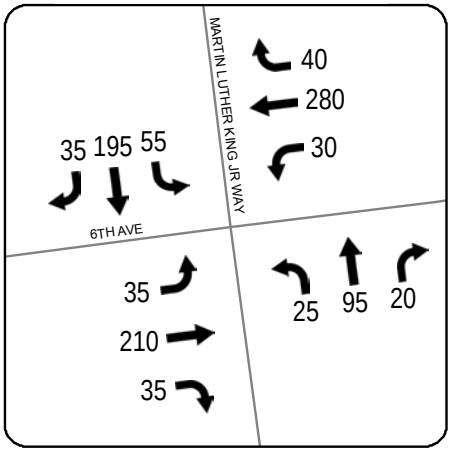
14 MLK Jr. Way & S 5th St



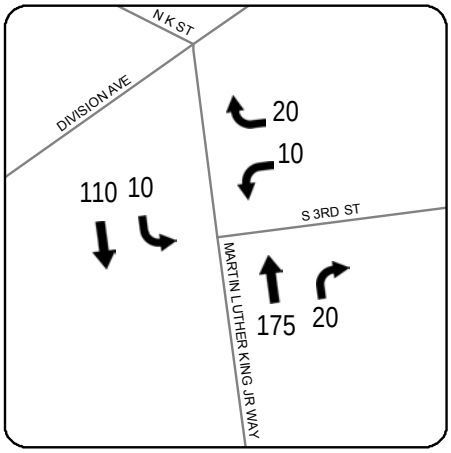
12 MLK Jr. Way & Division Ave



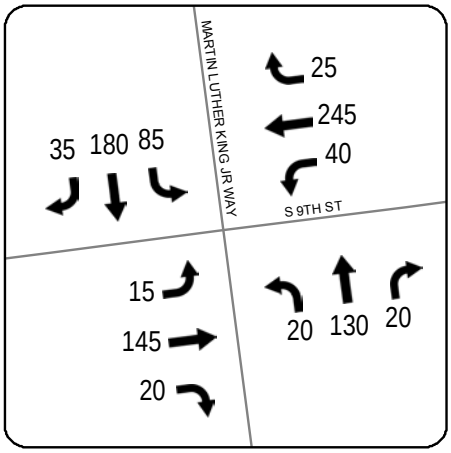
15 MLK Jr. Way & S 6th Ave

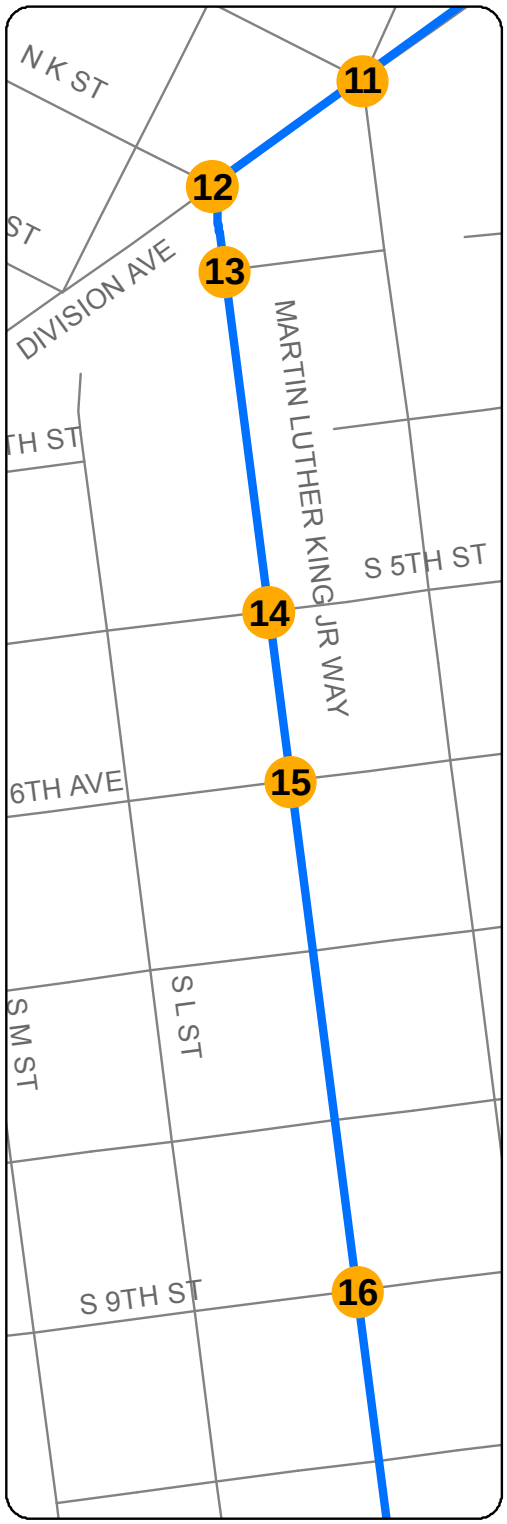


13 MLK Jr. Way & S 15th St



16 MLK Jr. Way & S 9th St





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 100 200 400 Feet

Data Source:
CH2M HILL (2014)

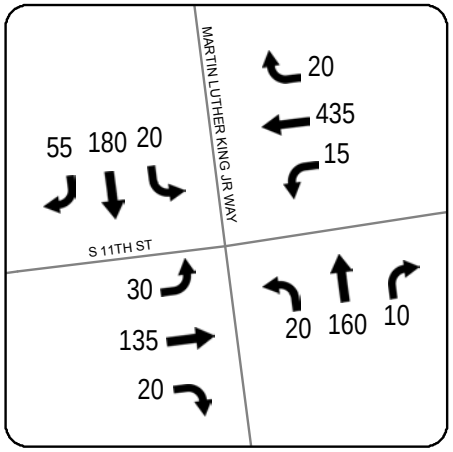
SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

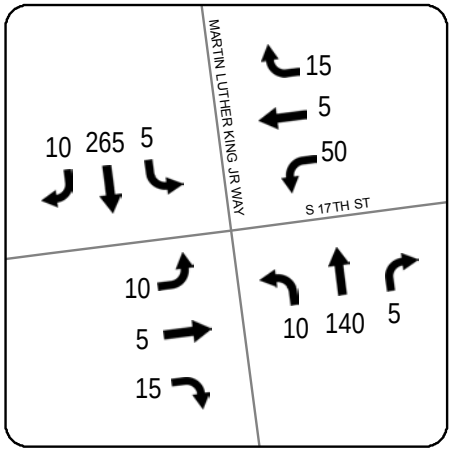
EXISTING PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 4-6

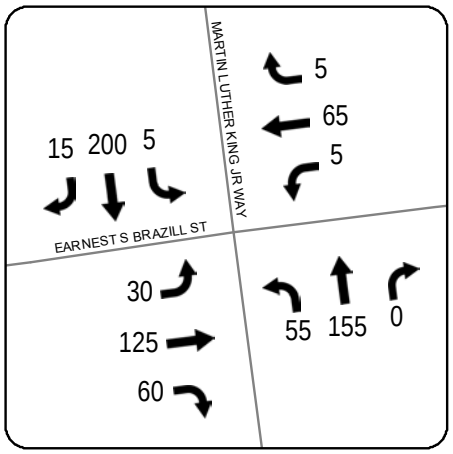
17 MLK Jr. Way & S 11th St



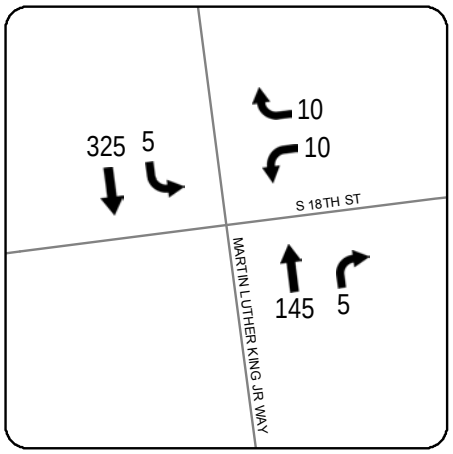
20 MLK Jr. Way & S 17th St



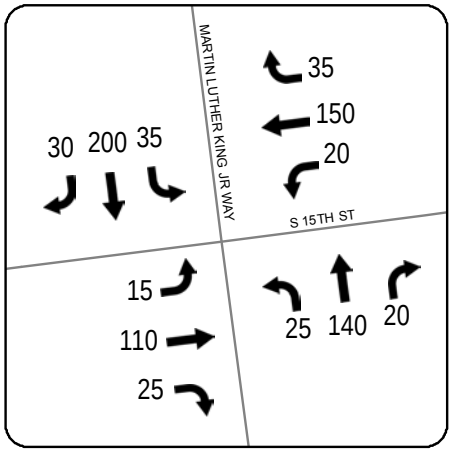
18 MLK Jr. Way & Earnest S Brazill



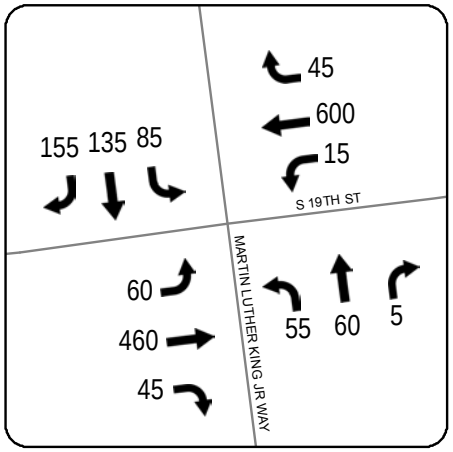
21 MLK Jr. Way & S 18th St

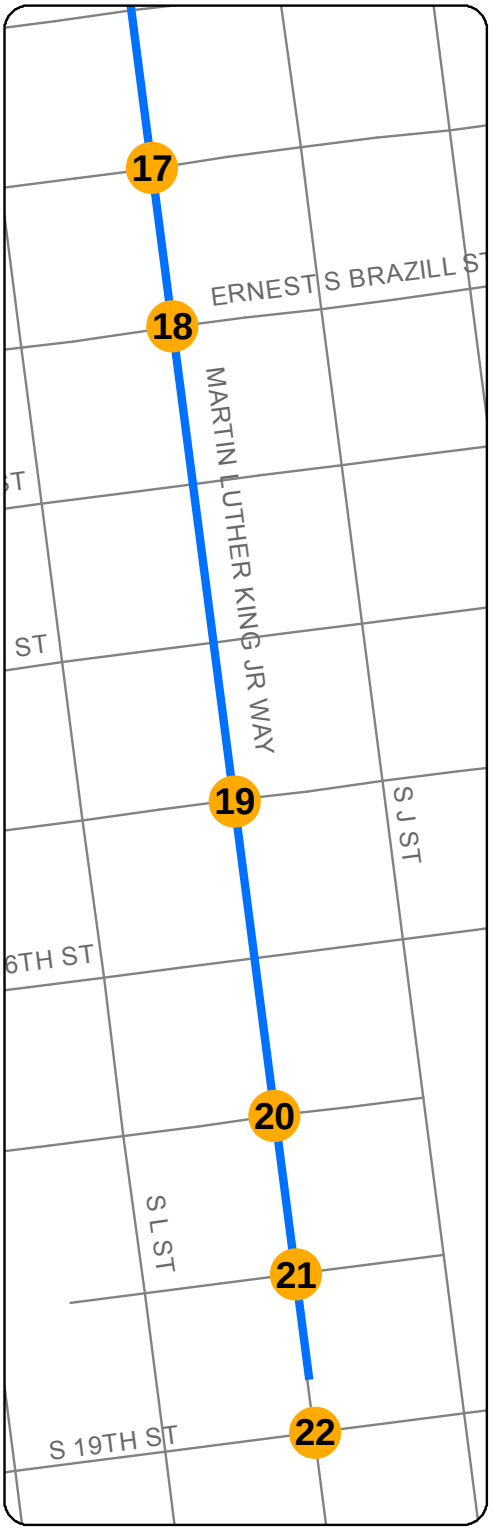


19 MLK Jr. Way & S 15th St



22 MLK Jr. Way & S 19th St





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 100 200 400 Feet

Data Source:
CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

TABLE 4-4
Level of Service Standards for City of Tacoma

Agency/Jurisdiction	Level of Service Standard
City of Tacoma [a]	LOS E for unsignalized and signalized intersections LOS D for transit vehicles

Notes:
[a] The City of Tacoma recently adopted the *North Downtown Subarea Plan* (City of Tacoma, 2014a) and *Hilltop Subarea Plan* (City of Tacoma, 2014b) which state that the LOS standard is LOS E. All study intersections are within these subareas.
LOS = level of service

Table 4-5 shows the standardized LOS criteria and thresholds for signalized and unsignalized intersection, as provided in the 2010 *Highway Capacity Manual* (HCM; Transportation Research Board, 2010). These thresholds were used to assess operating conditions for the existing and future conditions.

TABLE 4-5
Signalized and Unsignalized Intersection Traffic Operations: Level of Service Thresholds

Level of Service	Average Vehicle Delay Signalized (seconds per vehicle)	Average Vehicle Delay Unsignalized [a] (seconds per vehicle)	Traffic Flow Characteristics
A	Less than 10 seconds	Less than 10 seconds	Few or no traffic delays; individual users are virtually unaffected by the presence of other vehicles.
B	10 to 20 seconds	10 to 15 seconds	Short traffic delays; traffic flow is stable, but the presence of other users begins to be noticeable.
C	20 to 35 seconds	15 to 25 seconds	Average traffic delays; traffic flow is stable, but other traffic begins to significantly affect individual users.
D	35 to 55 seconds	25 to 35 seconds	Long traffic delays; traffic flow is dense but stable. Other users restrict individual driver maneuverability.
E	55 to 80 seconds	35 to 50 seconds	Very long traffic delays; operations are at or near capacity levels and unstable, and freedom to maneuver is difficult.
F	More than 80 seconds	More than 50 seconds	Extreme traffic delays; demand exceeds capacity, and delays and queuing may cause severe congestion. For unsignalized intersections, not enough gaps of suitable size are present along the major, uncontrolled street.

Notes:
[a] Unsignalized LOS is reported for the worst intersection movement, normally a stop-controlled, left-turn movement.
LOS = level of service

Exhibit 4-7 shows the overall intersection LOS. Two intersections operate at LOS D overall, and none operate at LOS E. Under PM peak-hour conditions, four intersections have one or more approaches that operate at LOS D. Only Division Avenue/Tacoma Avenue has more than one approach operating at LOS D; this is due to high traffic volumes, modest pedestrian activity, and split-signal phasing at this intersection. All 22 study intersections currently meet the respective LOS standards.

TACOMA LINK EXPANSION

EXISTING CONDITIONS: PM PEAK LEVEL OF SERVICE (LOS)

EXHIBIT 4-7

LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment

Existing Intersection LOS

	Signalized	Unsignalized
A - D		
E		
F		

0 0.125 0.25 0.5 Miles

SOUNDTRANSIT RIDE THE WAVE

Intersection storage lengths and 95th percentile queue lengths were also analyzed for each vehicle lane group during the PM peak hour. Vehicle queue lengths and other detailed traffic results, including LOS, delay, v/c ratios, are provided in Appendix C.

4.3.3 Traffic Safety

This section discusses current safety-related issues in the TLE corridor. Crash data records were collected for a 5-year period between 2009 and 2013 from the City of Tacoma for intersections within the transportation study area. Crash rates were calculated for the study area intersections as the number of crashes per million entering vehicles (MEV). The intersection of Division Avenue/I Street had the greatest number of crashes (41) over the 5-year period with a crash rate of 0.83 crashes/MEV. Commerce Street/7th Street had the highest intersection crash rate of 1.88 crashes/MEV. Because the crash rate was determined by the number of crashes per MEV, intersections that have low traffic volumes, including at the Commerce Street/7th Street, can have a higher crash rate, even if the frequency of crashes is low. Table 4-6 shows the intersection locations and indicates the intersection traffic volumes, crash frequency by type, and crash rates.

TABLE 4-6
Existing Intersection Crash Analysis Results (2009 to 2013)

Intersection Name	Average Daily Traffic [a]	2009 to 2013 Crash Frequency (number of crashes)				Crash Rate (crashes/MEV)
		Fatality	Injuries	Property Damage Only	Total	
Commerce Street/9th Street	16,100	0	6	9	15	0.51
Commerce Street 7th Street [b]	3,200	0	3	8	11	1.88
Stadium Way/I-705 ramps	24,100	0	0	9	9	0.20
Stadium Way/4th Street	21,500	0	3	5	8	0.20
Stadium Way/Division Avenue	17,000	0	7	14	21	0.68
Division Avenue/Tacoma Avenue	17,200	1	5	7	13	0.41
N 1st Street/Broadway Street	8,700	0	2	3	5	0.31
N 1st Street/Tacoma Avenue	14,900	1	3	11	15	0.55
N 1st Street/Division Avenue – Yakima Avenue	20,000	1	3	1	5	0.14
Division Avenue /I Street	27,100	0	22	19	41	0.83
Division Avenue/2nd Street – J Street	15,700	0	0	8	8	0.28
Division Avenue/K Street – MLK Jr. Way	15,300	0	3	1	4	0.14
MLK Jr. Way/3rd Street	4,400	0	0	1	1	0.12
MLK Jr. Way/5th Street	7,500	0	2	4	6	0.44
MLK Jr. Way/6th Avenue	13,300	0	7	11	18	0.74
MLK Jr. Way/9th Street	12,100	0	7	7	14	0.63
MLK Jr. Way/11th Street	13,900	1	6	7	14	0.55
MLK Jr. Way/Earnest S. Brazill	9,000	0	4	6	10	0.61
MLK Jr. Way/15th Street	10,200	0	2	5	7	0.38

TABLE 4-6
Existing Intersection Crash Analysis Results (2009 to 2013)

Intersection Name	Average Daily Traffic [a]	2009 to 2013 Crash Frequency (number of crashes)				Crash Rate (crashes/MEV)
		Fatality	Injuries	Property Damage Only	Total	
MLK Jr. Way/17th Street	6,800	0	1	1	2	0.16
MLK Jr. Way/18th Street	6,300	0	2	6	8	0.70
MLK Jr. Way/19th Street	21,700	0	13	18	31	0.78

Notes:
Source: City of Tacoma, 2014.
[a] Intersection average daily traffic represents the total entering vehicles per weekday.
[b] All crashes at the Commerce Street/7th Street intersection occurred prior to Commerce Street construction. Based on available data, no additional crashes have occurred since May 2012.
MEV = million entering vehicles

4.4 Parking

4.4.1 Existing Facilities

Curbside or other on-street parking within the public right-of-way is available along the proposed alignment and on adjacent streets. On-street parking restrictions vary substantially throughout the transportation study area. In general, on-street parking in the study area is classified into the following types:

- Unrestricted
- Time-restricted (30 minutes, 1 hour, 2 hour)
- Load zones
- Permit only
- Disabled

On-street parking areas are generally delineated with signage or curb markings. In a few locations, parallel parking stalls are demarcated; however, most locations do not have defined parking stalls. Intermittent angle parking is present in the study area, generally provided in the theater district area. Throughout most of the study area, on-street parking is free, except portions of North Downtown Tacoma, where pay-station parking is present.

Off-street parking is available at several large parking lots, both surface and structured. Along MLK Jr. Way, most large parking facilities are associated with healthcare facilities while parking facilities in the North Downtown Tacoma area are tailored to commercial uses. Several surface off-street parking facilities are also located in the Stadium District.

4.4.2 Parking Supply, Demand, and Utilization

A parking study was completed in summer 2014 to assess existing on-street parking conditions within the transportation study area. A parking supply and utilization study was conducted for parking areas located along the Tacoma Link Expansion alignment and up to two adjacent streets from the

alignment. The study included assessing whether a parking stall had a vehicle present during a typical AM (7 a.m. to 10 a.m.) and PM (3 p.m. to 6 p.m.) weekday peak period.

Table 4-7 show the parking supply by type and the utilization percentages for the AM and PM peak periods for the three subareas. Detailed parking utilization figures showing utilization on each block face are provided in Exhibit 4-8 and Exhibit 4-9 for the AM and PM peak periods, respectively.

TABLE 4-7
Existing On-Street Subarea Parking Supply, Demand, and Percent Utilization

Parking Area	Total Parking Supply (stalls)	Parking Demand (stalls)		Utilization (percent)	
		AM Peak Period	PM Peak Period	AM Peak Period	PM Peak Period
North Downtown/Stadium	820	480	535	59	65
Division/North MLK	755	545	390	72	52
South MLK	1,070	530	495	50	46

Notes:
Data collected on July 10, 2014.
Total parking supply and demand numbers are rounded up to nearest five stalls.

Parking utilization in excess of 80 percent (shown in red on Exhibits 4-8 and 4-9) represents high utilization locations and where finding on-street parking could be difficult. During both peaks, several block faces have high utilization, which is generally driven by adjacent land uses.

Around Tacoma General Hospital and St. Joseph Medical Center, parking utilization generally exceeds 80 percent in both peak periods, with more blocks having higher utilization during the AM peak period. To the west of Tacoma General Hospital, residential parking has high utilization during the AM peak period and moderate utilization during the PM peak period. Just south of Tacoma General Hospital along MLK Jr. Way, residential zones have high parking utilization rates; however, residential parking permits are required between 6th Avenue and N 7th Street. Near St. Joseph's Medical Center, residential parking west of MLK Jr. Way has low to moderate utilization during both the AM and PM peak periods. Most on-street parking areas in the Stadium District are highly utilized during at least one peak period. On-street parking along Commerce Street has high utilization rates during the PM peak period.

4.5 Nonmotorized Facilities

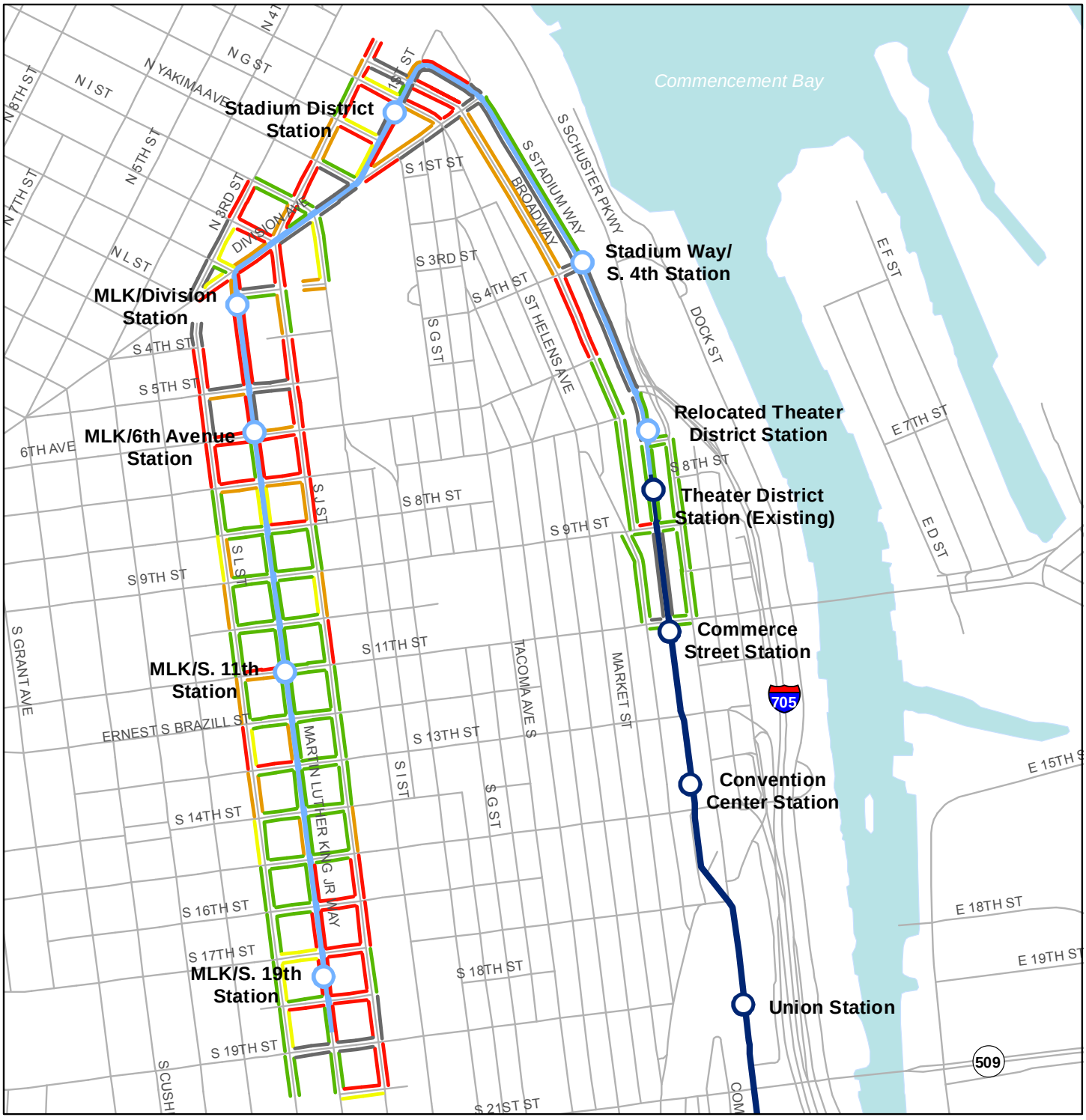
4.5.1 Existing Pedestrian and Regional Trail Facilities

Existing sidewalk coverage, midblock crosswalks, and regional trails are shown in Exhibit 4-10 through Exhibit 4-12. Sidewalks are present on most public rights-of-way throughout the transportation study area. Along the Tacoma Link Expansion alignment, crosswalks are present at most signalized intersections and at six midblock crossings. Many crosswalks at signalized intersections are unmarked or markings have been worn down so they are difficult to see, in particular along N 1st Avenue, Division Street, and MLK Jr. Way. There are a few exceptions, in particular at MLK Jr. Way/S 5th Street and at midblock crossings at MLK Jr. Way south of 3rd Street and on 1st Avenue just north of G Street. Crosswalks along Stadium Way and Commerce Street are easily identifiable and in good condition.

TACOMA LINK EXPANSION

EXISTING CONDITIONS PARKING SUPPLY AND UTILIZATION (AM)

EXHIBIT 4-8



LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment

On-Street Utilization

- No Parking
- Low Use (0 - 50%)
- Med-Low Use (51 - 65%)
- Med-High Use (66 - 80%)
- High Use (81 - 100%)

0 0.125 0.25 0.5 Miles

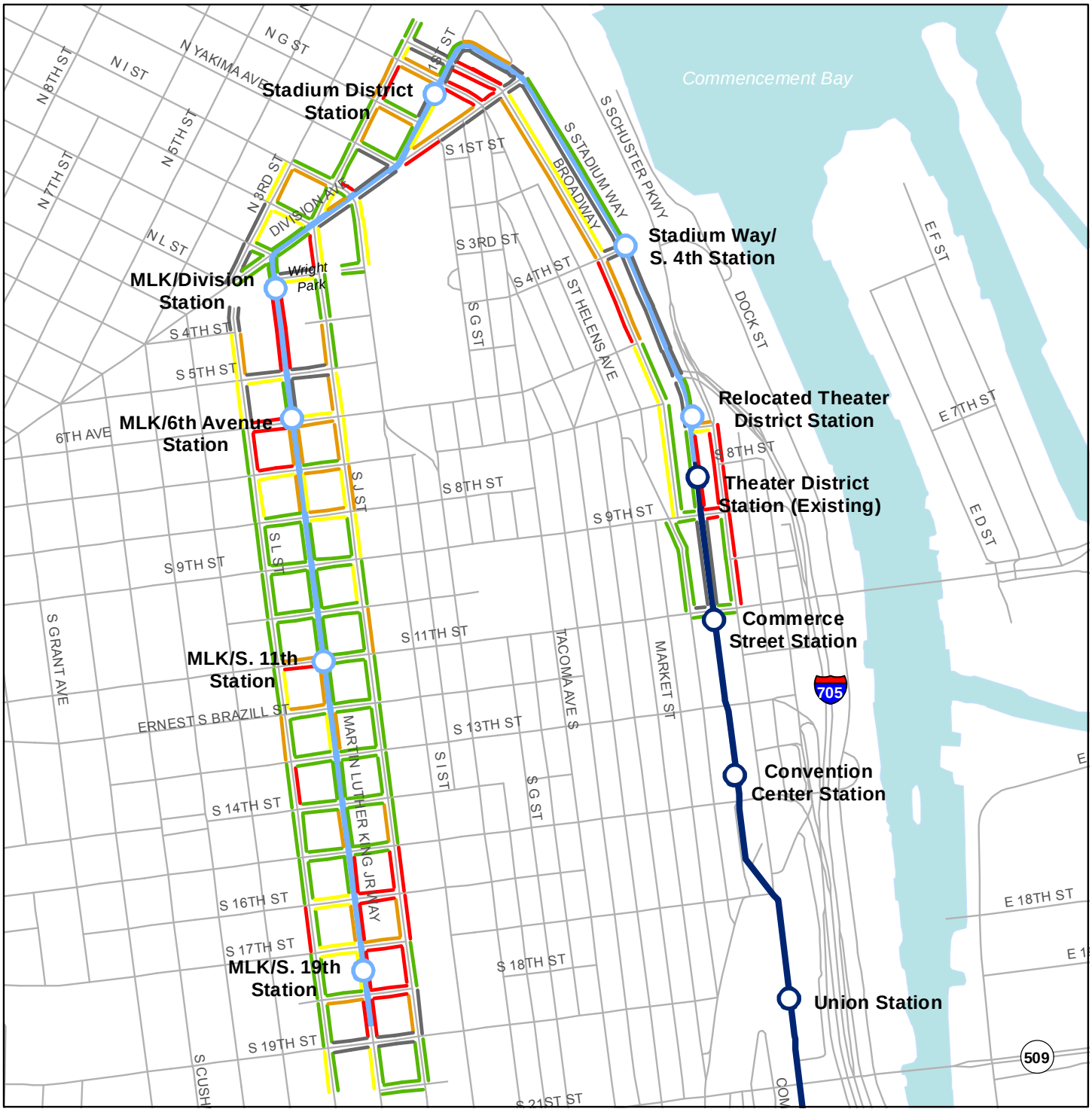
Data source: CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

EXISTING CONDITIONS PARKING SUPPLY AND UTILIZATION (PM)

EXHIBIT 4-9



LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment

On-Street Utilization

- No Parking
- Low Use (0 - 50%)
- Med-Low Use (51 - 65%)
- Med-High Use (66 - 80%)
- High Use (81 - 100%)

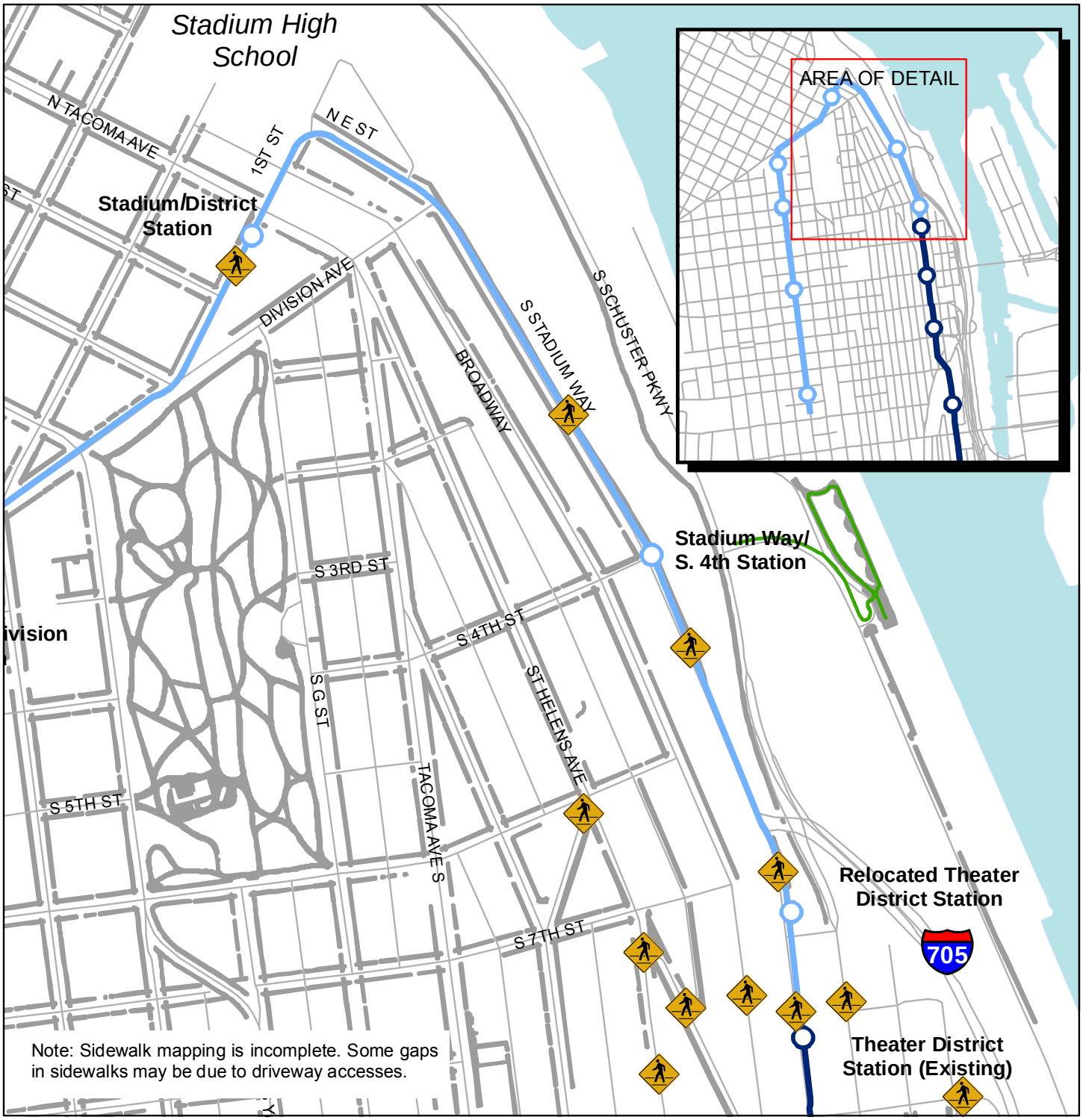
0 0.125 0.25 0.5 Miles

Data source: CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION
EXISTING PEDESTRIAN FACILITIES (THEATER DISTRICT)

EXHIBIT 4-10



Legend

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Sidewalks (2005)
- Mid-Block Crossings (2013)
- Regional Trails

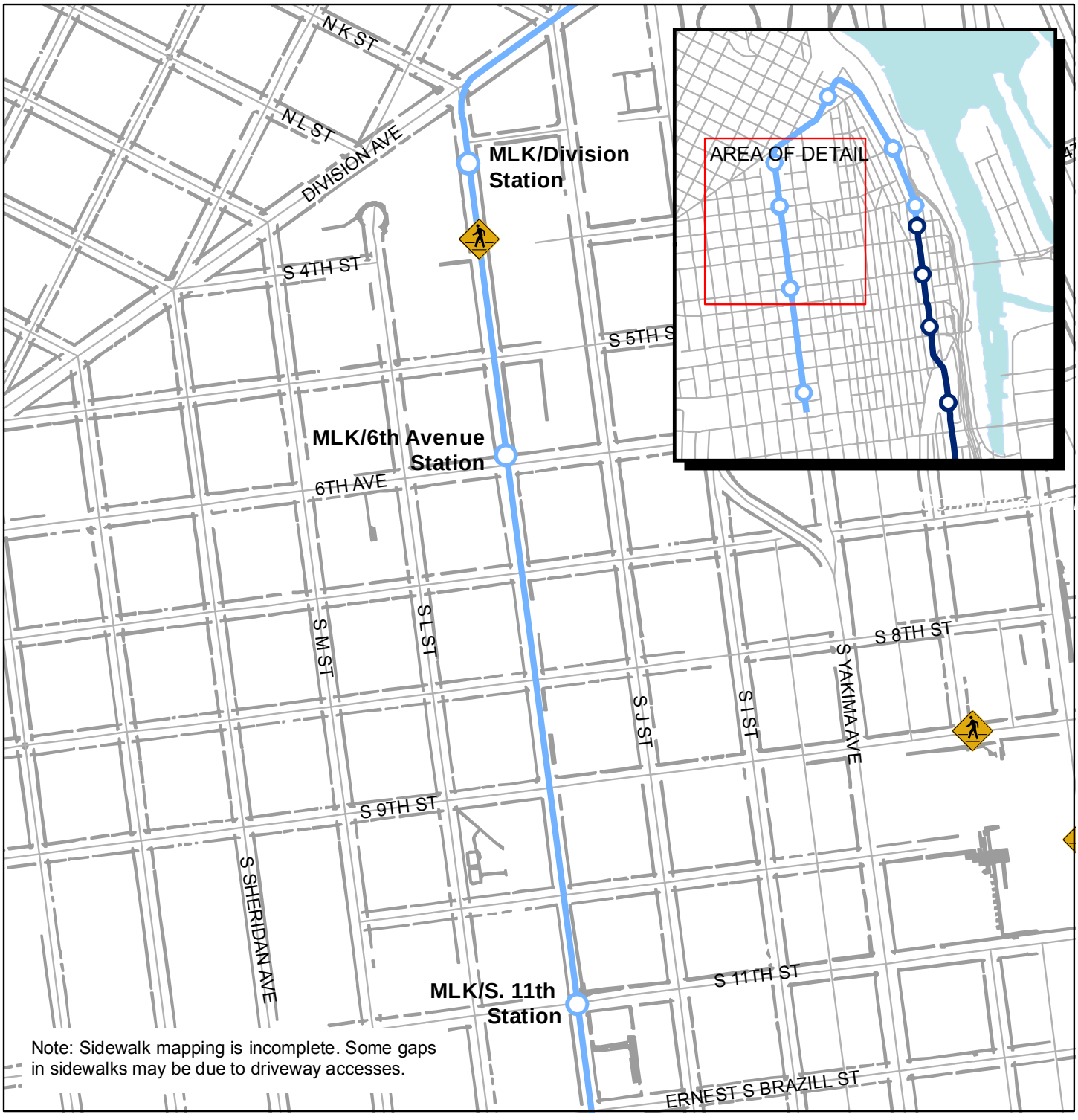
0 0.05 0.1 0.2 Miles

Data Sources:
CH2M HLL (2013). Mid-Block Crossings digitized using latest available Google Imagery. Sidewalk data from City of Tacoma GIS (2005).

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION
EXISTING PEDESTRIAN FACILITIES (NORTH MLK)

EXHIBIT 4-11



Legend

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Sidewalks (2005)
- Mid-Block Crossings (2013)
- Regional Trails

0 250 500 1,000 Feet

Data Sources:
CH2M HLL (2013). Mid-Block Crossings digitized using latest available Google Imagery. Sidewalk data from City of Tacoma GIS (2005).

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION
EXISTING PEDESTRIAN FACILITIES (SOUTH MLK)

EXHIBIT 4-12

Legend

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Sidewalks (2005)
- Mid-Block Crossings (2013)
- Regional Trails

0 250 500 1,000 Feet

Data Sources:
CH2M HLL (2013). Mid-Block Crossings digitized using latest available Google Imagery. Sidewalk data from City of Tacoma GIS (2005).

SOUNDTRANSIT RIDE THE WAVE

Midblock crossings generally have flashing warning beacons to provide a warning to motorists and are activated by pedestrian push buttons. No multiuse trails are present inside the transportation study area. However, Wright Park, located south of Division Avenue between S "I" Street and S "G" Street, contains multiple trails that connect the Stadium District with the North Downtown and Hilltop neighborhoods.

4.5.2 Existing Bicycle Facilities

Exhibit 4-13 identifies the existing bicycle facilities in the transportation study area. Bicycle facility location and type are documented from the *North Downtown Subarea Plan* (City of Tacoma. 2014a) and *Hilltop Subarea Plan* (City of Tacoma, 2014b). There are few dedicated bicycle facilities in the study area. Stadium Way is the only roadway along the Tacoma Link Expansion alignment that currently has a designated bicycle lane. S 15th Street, which bisects the transportation study area, also has marked bicycle lanes. J Street, which is one block east of MLK Jr. Way, is currently proposed as a bicycle boulevard but currently does not have marked bicycle lanes.

4.6 Freight Mobility and Access

Truck mobility within the Puget Sound region is largely supported by a system of designated freight routes that consist of freeways and arterial streets connecting major freight destinations. To prioritize truck routes, the Washington State Department of Transportation adopted the Freight Goods Transportation System (FGTS), which classifies roadways according to the amount of annual tonnage transportation (T1 to T5). The classifications range from roadways that carry more than 20,000 tons in 60 days to those that carry more than 10,000,000 tons annually (Table 4-8). Jurisdictions determine their designated truck route system on arterial streets according to the FGTS classifications.

TABLE 4-8
Freight and Goods Transportation System Classifications

Freight Goods Transportation System Classification	Annual Gross Tonnage
T-1	More than 10,000,000
T-2	4,000,000 to 10,000,000
T-3	300,000 to 4,000,000
T-4	100,000 to 300,000
T-5	More than 20,000 in 60 days

Source: Washington State Legislative Transportation Committee, 1995

I-705 is the only FGTS-classified (T2) roadway in the study area. The section of I-705 connects the Port of Tacoma with national and international markets via I-5 and is a key freight corridor. More than 4.4 million tons of freight are hauled annually on I-705, and about 4 percent of the vehicles that travel on the road are trucks.

Other facilities in the study area carry truck traffic, however, they are not designated as freight routes. Most truck traffic provides local deliveries to nearby businesses and residential areas. During the PM peak hour, trucks account from 1 to 5 percent of vehicle traffic along the Tacoma Link alignment.

TACOMA LINK EXPANSION

EXISTING BICYCLE FACILITIES

EXHIBIT 4-13

Legend

- Existing
- Proposed
- Existing Stations
- Proposed Stations
- Existing Operations and Maintenance Facility Site
- Proposed Operations and Maintenance Facility Expansion Site
- Bike Lane
- Marked Shared Lane
- Regional Trails

0 0.125 0.25 0.5 Miles

Data Sources: City of Tacoma (2012) and CH2M HILL (2013)

SOUNDTRANSIT RIDE THE WAVE

5.0 Environmental Impacts

The future long-term effects described in the following sections are a comparison of the No Build Alternative and TLE Build Alternative for the horizon year of 2035. Agency and station long-range plans were reviewed and foreseeable projects were assumed.

Modifications to the transportation system assumed to be in place under the No Build Alternative and TLE Build Alternative are described in Appendix A. The effects of the TLE Build Alternative were analyzed assuming that the Tacoma Link would extend to the MLK Jr. Way and S 19th Street. Potential mitigation to improve conditions was also identified for the TLE Build Alternative and are described further in Section 7.

5.1 Regional Facilities and Travel

Regional travel patterns, including projected vehicle forecasts, traffic congestion, and mode share for the No Build and TLE Build Alternatives are discussed in detail in this subsection. The future arterial and local street system within the transportation study area includes a variety of roadway and transit projects. These reasonably foreseeable projects were incorporated into the transportation analysis for the 2035 No Build Alternative and TLE Build Alternative. The Pierce County model used for the Pacific Avenue Streetscape Project, which was used for the basis of future year volume projections, included the regionally significant projects.

In addition to regionally significant projects, the following local jurisdiction transportation improvements in the study area were assumed for the year 2035 No Build Alternative and TLE Build Alternative for the transportation analysis:

- Thea Foss – Public Parking – 15th and Hood (public parking)
- Schuster Parkway Trail (Nonmotorized)
- Prairie Line Trail Phase 1 (Nonmotorized)
- Pacific Avenue Streetscape (Nonmotorized)
- 17th Street Extension and University of Washington – Tacoma Improvements

Traffic volumes are expected to increase from existing conditions because travel patterns are not forecasted to change appreciably and regional population growth would continue.

5.1.1 Vehicle Miles Traveled and Vehicle Hours Traveled

Table 5-1 shows the daily VMT and VHT for the No Build Alternative and TLE Build Alternative for the horizon year 2035. With the expansion of Tacoma Link to MLK Jr. Way/S 19th Street, regional VMT would decrease by approximately 15,000 miles on a typical weekday compared with the No Build Alternative. The TLE would improve transit service in Downtown Tacoma, the Stadium District, and the Hilltop neighborhoods and would connect these communities with the Tacoma Dome. From the Tacoma Dome, connections could be made to regional destinations, including Downtown Seattle.

Because the TLE would serve a larger population and employment base, people would be more likely to use transit rather than drive, thus resulting in a regional decreases in VMT and VHT.

TABLE 5-1
2035 Weekday Daily Vehicle Miles of Travel and Vehicle Hours of Travel

Alternative	Vehicle Miles Traveled	Vehicle Hours Traveled
No Build	103,714,000	3,357,000
Tacoma Link with Expansion (Build)	103,699,000	3,357,000
Change	-15,000	Less than -1,000 [a]

Source: Pierce County, 2011
[a] Values rounded to the nearest 1,000.

Forecasted regional VHT are expected to be similar to the no build with the TLE. Specific transit ridership for the TLE Build Alternative is discussed in Section 5.2.2.

5.1.2 Screenline Performance

The PM peak-hour and daily traffic screenline volumes and v/c ratios were analyzed at the five selected screenline locations within the transportation study area (Exhibit 4-1 shows the project's five screenline locations). Screenline results are similar between the No Build and TLE Build Alternatives, as shown in Table 5-2.

TABLE 5-2
2035 PM Peak/Daily Screenline Volumes and Volume-to-Capacity Ratios

Screenline	Direction	PM Peak Hour				Daily	
		No Build		Tacoma Link with Expansion		No Build Volume (vehicles)	Tacoma Link with Expansion Volume (vehicles)
		Volume (vehicles)	Volume/ Capacity	Volume (vehicles)	Volume/ Capacity		
Screenline S-1—G Street between S 3rd Street and S 7th Street	EB	1,000	0.30	1,000	0.29	11,000	11,000
	WB	1,050	0.30	1,050	0.30	12,300	12,200
Screenline S-2—S 10th Street between Dock Street and S Tacoma Ave	NB	3,650	0.35	3,600	0.35	37,600	37,200
	SB	3,450	0.35	3,400	0.34	39,900	39,500
Screenline S-3— S 18th Street between Dock Street and S Tacoma Ave	NB	5,300	0.36	5,250	0.36	64,600	64,000
	SB	6,400	0.60	6,350	0.59	65,800	65,200
Screenline S-4— S 10th Street between S Tacoma Avenue and M Street	NB	1,000	0.27	1,000	0.26	10,300	10,000
	SB	850	0.22	850	0.22	9,600	9,400
Screenline S-5— S 18th Street between S Tacoma Avenue and M Street	NB	900	0.24	850	0.24	12,700	12,300
	SB	1,350	0.36	1,300	0.35	12,100	11,900

TABLE 5-2
2035 PM Peak/Daily Screenline Volumes and Volume-to-Capacity Ratios

Screenline	Direction	PM Peak Hour				Daily	
		No Build		Tacoma Link with Expansion		No Build Volume (vehicles)	Tacoma Link with Expansion Volume (vehicles)
		Volume (vehicles)	Volume/ Capacity	Volume (vehicles)	Volume/ Capacity		

Source: Sound Transit, 2012; Pierce County, 2011

Notes:
Peak-hour traffic volumes were rounded to the nearest 50 vehicles, and daily traffic volumes were rounded to the nearest 100 vehicles.

EB = eastbound
NB = northbound
SB = southbound
WB = westbound

Extending Tacoma Link to MLK Jr. Way/ S 19th Street would attract more persons to transit, thus resulting in minor decreases in traffic volumes and congestion across all screenline locations within the corridor. Small decreases are expected in both the peak and off-peak directions of travel. Most roads across the screenline would operate under capacity in the peak direction of travel with and without the TLE, and congestion would be similar with the TLE Build Alternative.

5.1.3 Person Mode of Travel

Table 5-3 shows the total person demand and their mode of travel at the five screenline locations during the PM peak hour. A slight decrease in automobile person demand is expected with the TLE Build Alternative, as persons are shifting from automobile modes to transit. The increase in transit person trips with the TLE would also be due to person trips that may have previously used nonmotorized modes of travel or are new trips. The percent of the transit mode share in the total mode share for the PM peak period would increase substantially, with up to a 34 percent transit mode share with the TLE in the study area.

5.2 Transit Service and Operations

Transit service and circulation, regional and local bus transit, ridership, station area mode of access, and bus and Tacoma Link vehicle travel times for the No Build and TLE Build Alternatives are discussed in this subsection.

5.2.1 Transit Service Assumptions

A variety of changes could occur to transit operations by 2035. To provide a seamless, complementary transit network with the TLE, a transit integration plan (Appendix D) was developed to coordinate bus service and the proposed TLE. Local transit agencies, Pierce Transit and Sound Transit, have identified a conceptual transit bus service plan that includes rerouting of transit service, truncating service areas, and providing transit connections in the project area. It should be noted that actual changes to bus routes would require agency approval prior to implementation. Exhibit 5-1 shows the proposed transit routes with the TLE. The proposed route changes are briefly described below:

TABLE 5-3
2035 PM Peak-hour Mode Share

Screenline	Direction	No Build			Tacoma Link with Expansion		
		Total Persons	Auto	Transit	Total Persons	Auto	Transit
Screenline S1—G Street between S 3rd Street and S 7th Street	EB	1,350	89%	11%	1,650	74%	26%
	WB	1,500	83%	17%	1,850	66%	34%
Screenline S2—S 10th Street between Dock Street and S Tacoma Avenue	NB	4,800	91%	9%	4,950	88%	12%
	SB	4,350	95%	5%	4,500	91%	9%
Screenline S3— S 18th Street between Dock Street and S Tacoma Avenue	NB	7,550	84%	16%	7,700	82%	18%
	SB	8,400	91%	9%	8,450	90%	10%
Screenline S4— S 10th Street between S Tacoma Avenue and M Street	NB	1,200	99%	1%	1,400	86%	14%
	SB	1,000	99%	1%	1,150	87%	13%
Screenline S5— S 18th Street between S Tacoma Avenue and M Street	NB	1,100	97%	3%	1,200	87%	13%
	SB	1,650	96%	4%	1,700	91%	9%

Source: Sound Transit, 2012; Pierce County, 2011

Notes:

Numbers may not add to 100 percent due to rounding.

EB = eastbound
NB = northbound
SB = southbound
WB = westbound

- Terminate the Pierce Transit Route 102 express bus in either downtown Tacoma or at the Tacoma Dome Station and eliminate the route's service on MLK Jr. Way, S 9th Street, and S 11th Street.
- Reroute the Pierce Transit Route 14 bus to serve MLK Jr. Way, thereby replacing the service eliminated on Sound Transit Route 102 Express. Eastbound Route 14 would turn southbound onto MLK Jr. Way from Division Avenue and could provide bus service near the proposed Link stations at 3rd Street and 6th Avenue along MLK Jr. Way.
- Reroute the Pierce Transit Route 57 to minimize duplicative service along the portion of MLK Jr. Way that would be served by both the TLE project and this bus route.
- Adjust Pierce Transit Route 28 to operate on 11th Street to directly serve the TLE stop at MLK Jr. Way and 11th Street.

Key Ridership Definitions

- **Transit boardings—**The entry of passengers onto a transit vehicle.
- **Transit trips—**The transit route between a starting location and an ending location. A transit trip could have one or more transit boardings if a transfer occurs.
- **Project riders—**Total boardings or alightings that occur in the Tacoma Link Expansion study area, including trips that may have either a boarding or alighting occur outside the study area.
- **New transit riders—**Any person who shifted to transit from a non-transit mode.

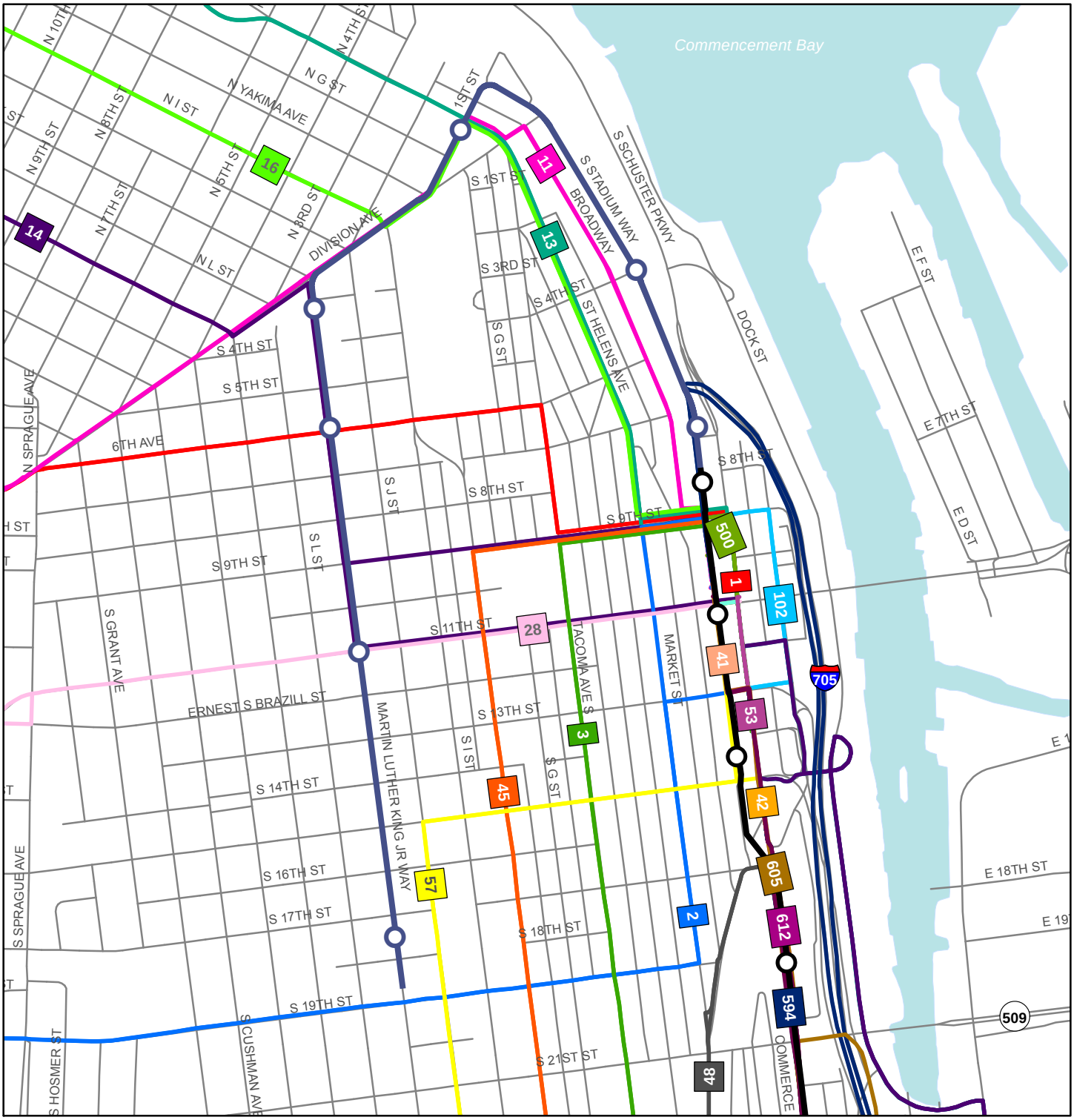
5.2.2 Ridership

Table 5-4 shows the 2035 total transit trips for the No Build Alternative and TLE Build Alternative in the region. Table 5-4 also documents the expected daily ridership on the Link and change in new transit riders with TLE Build Alternative.

TACOMA LINK EXPANSION

2035 CONCEPTUAL TRANSIT ROUTES AND SERVICE

EXHIBIT 5-1



Legend

- Existing Stations
- ProposedStations
- Existing Alignment
- Proposed Alignment
- Conceptual Transit Routes

0 0.1 0.2 0.4 Miles

Note: Some routes are overlaid on top of other routes; therefore not all routes are visible. Actual changes to bus routes would require agency approval prior to implementation.

Source: Sound Transit, 2014b; Pierce Transit, 2014; Intercity Transit, 2014

Date: 12/23/2014

SOUNDTRANSIT RIDE THE WAVE

TABLE 5-4
2035 Tacoma Link Weekday Transit and Project Riders

Measure of Effectiveness	No Build	Tacoma Link with Expansion	New Transit Riders with Tacoma Link Expansion
Total daily transit riders [a]	312,000	315,000	3,000
Total Tacoma Link riders	6,600	10,800	N/A

Notes:
Source: STOPS Model, 2012
[a] Includes both light rail and bus riders.
N/A = not applicable

Transit trips are expected to increase from 215,000 trips under existing conditions to 312,000 trips under the No Build Alternative due to increases in population, employment, and the attractiveness of transit as roadways become increasingly more congested. Under the TLE Build Alternative, the number of daily transit boardings is expected to increase by about 3,000 people per day compared with the No Build Alternative.

Average 2035 weekday station boardings are shown in Table 5-5 for the No Build Alternative and TLE Build Alternative. For the No Build Alternative, with the existing alignment and six stations, the total daily boardings on the Tacoma Link would be 6,600 boardings per day. With the TLE Build Alternative, total daily boardings on the Tacoma Link would be 10,800 boardings per day, with the expansion and 12 stations. At most existing stations, total daily boarding would slightly decrease. Some transit users who were previously using stops along Commerce Street, such as Union Station, Convention Center, and the Theater District, would relocate to stations along MLK Jr. Way. These stations would better serve those riders by reducing overall travel times (walk and transit) and would be located closer to the riders starting or ending destination.

5.2.3 Tacoma Link Vehicle and Automobile Travel Times

The TLE vehicle travel times between the existing Theater District Station and the MLK Jr. Way/19th Street Station along the alignment are presented in Table 5-6 for both the No Build Alternative and the TLE Build Alternative. Travel times are presented for both Tacoma Link vehicle and for automobiles. The vehicle travel times include not only include running time, but any delay incurred at signals and an assumed 30 second dwell time at each station. The automobile travel time in the TLE Build Alternative also includes any vehicle delay incurred while waiting for a train at a station platform.

Travel times are expected to be between 12.9 and 14.2 minutes for both the inbound and outbound Tacoma Link vehicles. Automobile travel times are expected to increase with the TLE by up to 0.6 minute in the inbound and by up to 1.6 minutes the outbound travel direction compared with the No Build Alternative.

TABLE 5-5
2035 Tacoma Link Weekday Station Boardings

Station Location	No Build	Tacoma Link with Expansion
Tacoma Dome	1,800	2,300
S 25th	400	200
Union Station	1,200	900
Convention Center	1,600	1,300
Commerce	300	300
Theater	1,300	800
Stadium Way/ S 4th	N/A	100
Stadium District	N/A	800
MLK Jr. Way/ 3rd	N/A	1,300
MLK Jr. Way/ 6th	N/A	500
MLK Jr. Way/S 11th	N/A	800
MLK Jr. Way/ S 19th	N/A	1,500
Total Boardings for all Stations	**6,600**	**10,800**

Notes:
Source: STOPS Model, 2012
N/A = not applicable

TABLE 5-6
2035 No Build and Build Alternative Automobile and Tacoma Link Vehicle Travel Times

Subarea	Travel Time (minutes)		
	No Build: Auto	Build: Auto	Build: Tacoma Link Vehicle
Outbound Direction			
North Downtown and Stadium: Commerce/9th to 1st/Division	4.8	5.7	5.1
Division and North MLK: 1st/Division to MLK Jr. Way/9th Street	3.4	3.5	4.8
South MLK: MLK Jr. Way/9th Street to MLK Jr. Way/19th Street	3.4	3.9	4.2
Total	**11.5**	**13.1**	**14.2**
Inbound Direction			
South MLK: MLK Jr. Way/9th Street to MLK Jr. Way/19th Street	3.7	3.5	3.6
Division and North MLK: 1st/Division to MLK Jr. Way/9th Street	2.8	3.2	4.3
North Downtown and Stadium: Commerce/9th to 1st/Division	4.2	4.5	5.0
Total	**10.6**	**11.2**	**12.9**

Note: Subarea and total number may not add due to rounding.

5.3 Arterial and Local Street Operations and Safety

5.3.1 Traffic Forecasts

The 2035 travel demand models developed for the Pacific Avenue Streetscape Project were used for the forecast of future vehicle trips with and without the proposed TLE project. The travel demand model was refined to reflect network improvements specific to the project corridor. Overall, by 2035, traffic volumes in the transportation study area are expected to increase by an average annual growth rate of approximately 0.5 percent during the PM peak hour.

Intersection traffic projections utilized traffic volume forecasts from the travel demand model. Growth rates from the existing and future travel demand models were applied to existing traffic volume counts to developed estimated future PM peak-hour turning movements using the guidelines outlined in the National Cooperative Highway Research Program 255. Traffic volumes in the year 2035 No Build and Build scenarios are assumed to be the same since no major changes in network capacity would occur with the TLE project. Year 2035 traffic volumes are shown in Exhibit 5-2 through Exhibit 5-5.

5.3.2 Property Access and Management

TLE would have some effect on property access and traffic circulation along the alignment near stations. Depending on the driveway location, private property access could be converted from full access to right-in, right-out, multiple driveways may be consolidated, or driveways may be relocated from their current location to elsewhere on the property. These impacts are identified in the conceptual engineering plans and may change as the project design progresses. Exhibit 5-6 shows the changes in property access due to the TLE. Based on the conceptual engineering plans, six driveways along the alignment would be converted from full access to right-in, right-out. Two driveways that provide access to a surface-level parking lot on Commerce Street would be modified, because the median platform associated with the Relocated Theater District Station would block access. Vehicles that accessed these lots traveling northbound on Commerce Street would need to be rerouted to Broadway, travel north, and access southbound Stadium Way at S 4th Street. Two driveways, including one serving a multifamily property, would be modified as the Stadium Way and 4th Street Station, because the station would block access to and from northbound Stadium Way. For trips into these developments from Stadium Way, vehicles would have to be rerouted to 4th Street, continue north on Broadway, turn east on Division Street, and head south on Stadium Way. Leaving these properties, automobiles would turn west on 4th Street and continue north on Broadway. Two other driveways, one on the northwest corner of MLK Jr. Way/S 19th Street and another at the southeast corner of MLK Jr. Way/S 18th Street, would also be restricted to right-in, right-out to avoid conflict with the TLE tail track located in the median of MLK Jr. Way. However, for these two driveways, alternate access would be provided and a circuitous reroute would not be required.

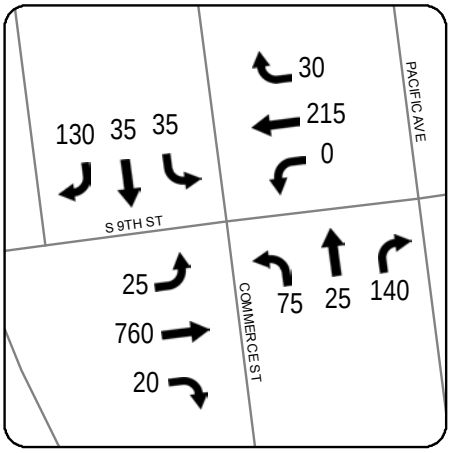
One property at the southeast corner of MLK Jr. Way/S 11th Street would have its driveway relocated slightly south of its current location to accommodate the curbside station. No other change in access on public roads, trails, or other rights-of-way are currently expected with the TLE.

TACOMA LINK EXPANSION

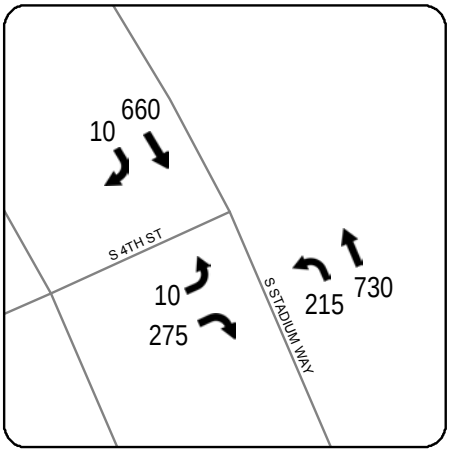
2035 NO BUILD & BUILD PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 5-2

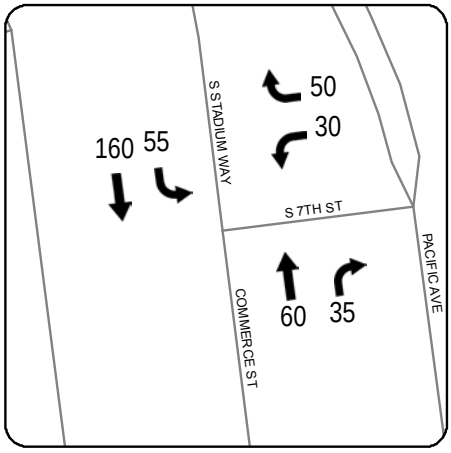
1 Commerce St & S 9th St



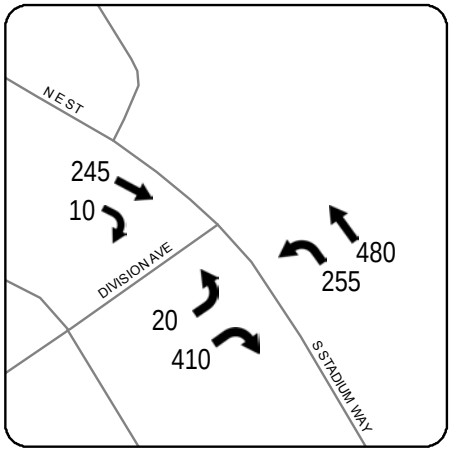
4 S Stadium Way & S 4th St



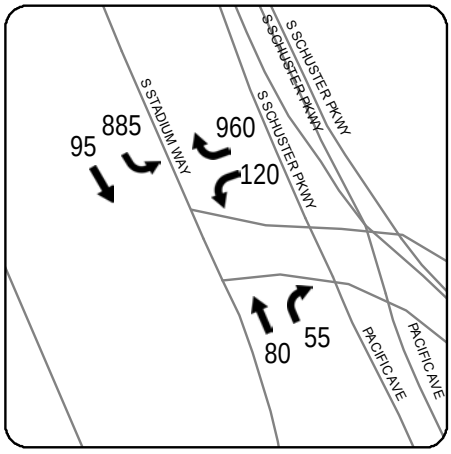
2 Commerce Ave & S 7th St

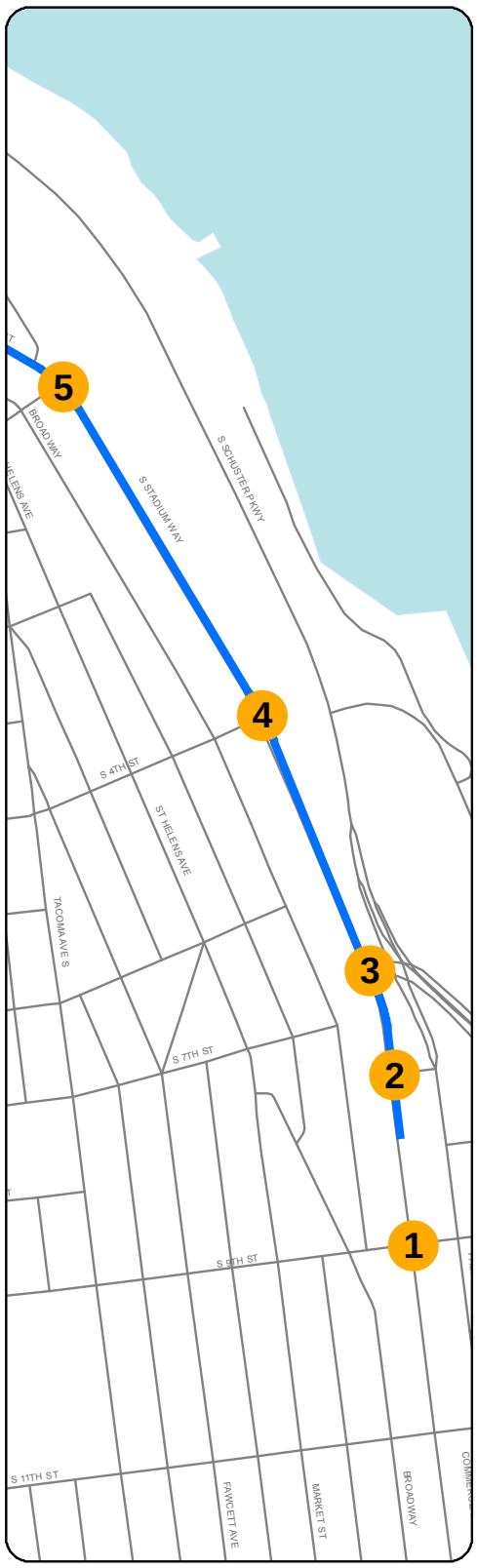


5 S Stadium Way & Division Ave



3 S Stadium Way & I-705 Ramps





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 375 750 1,500 Feet

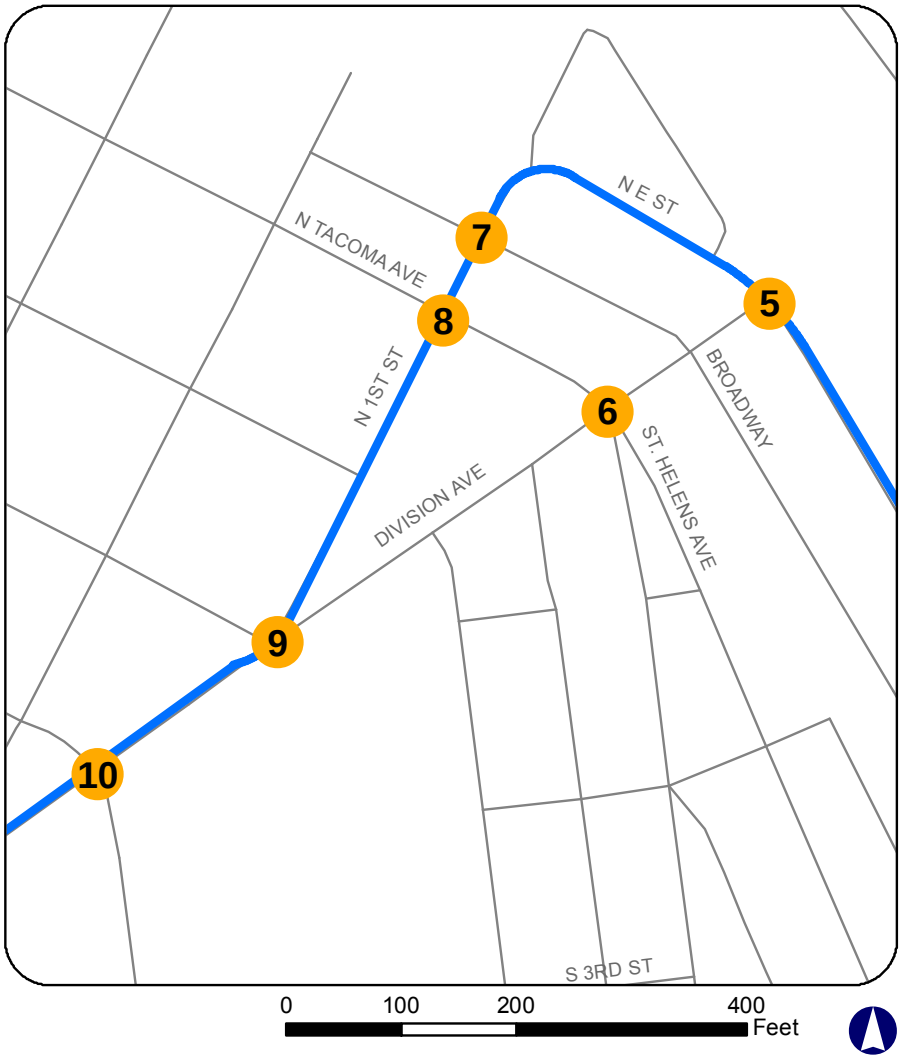
Data Source:
CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

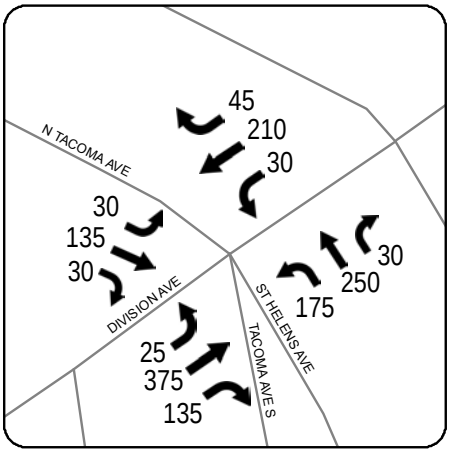
TACOMA LINK EXPANSION

2035 NO BUILD & BUILD PM PEAK HOUR TRAFFIC VOLUMES

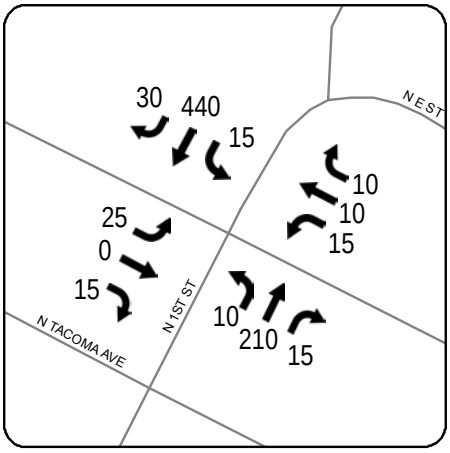
EXHIBIT 5-3



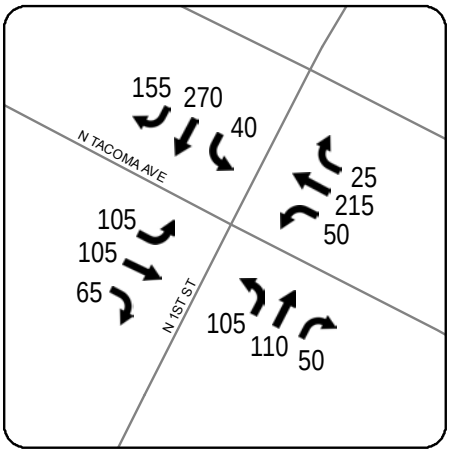
6 Division Ave & N Tacoma Ave



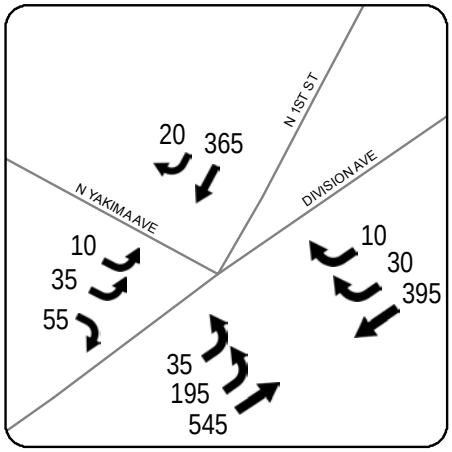
7 N 1st St & N Broadway St



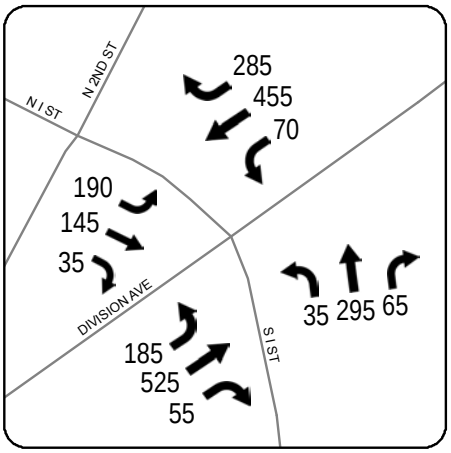
8 N 1st St & N Tacoma Ave



9 Division Ave & N 1st St



10 Division Ave & I (Eye) St



Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

Data Source:
CH2M HILL (2014)

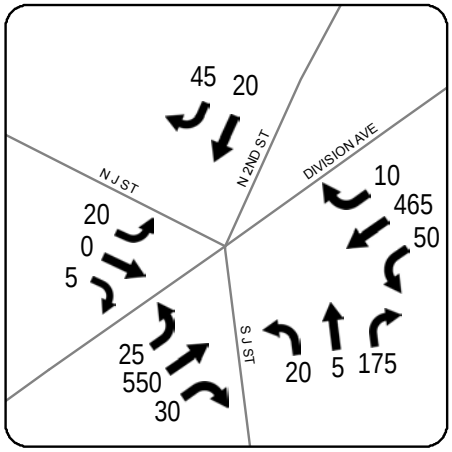
SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

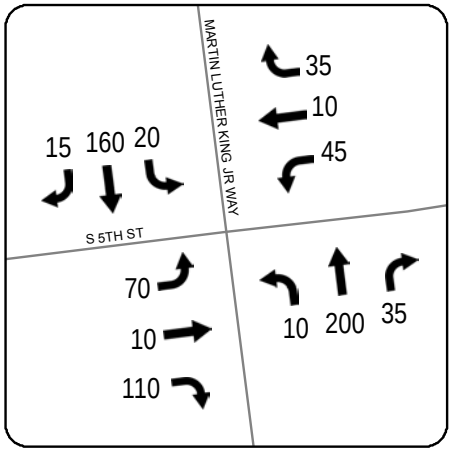
2035 NO BUILD & BUILD PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 5-4

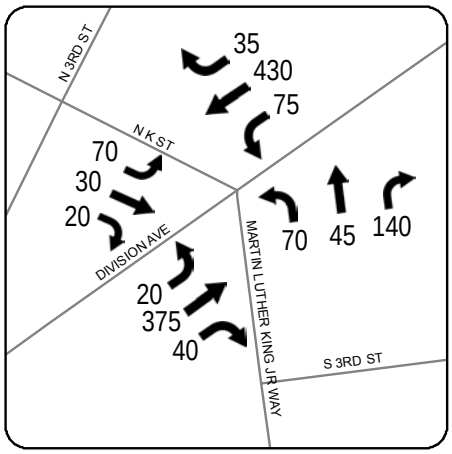
11 Division Ave & N J St/N 2nd St



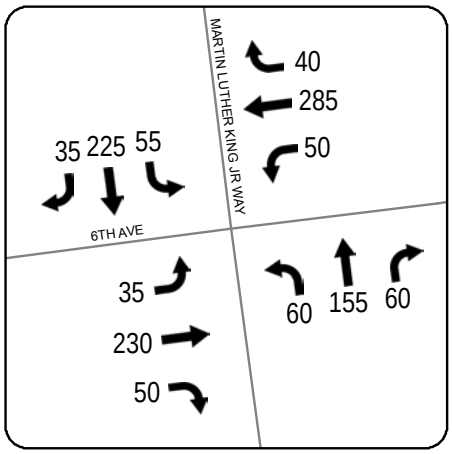
14 MLK Jr. Way & S 5th St



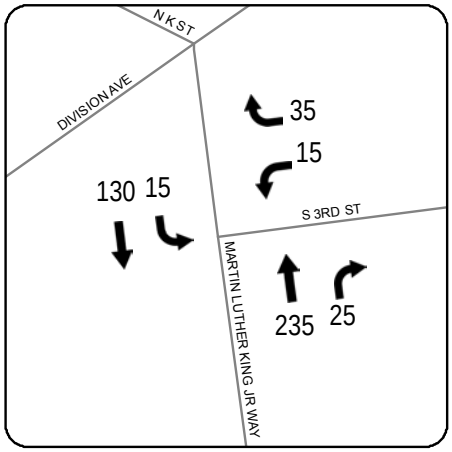
12 MLK Jr. Way & Division Ave



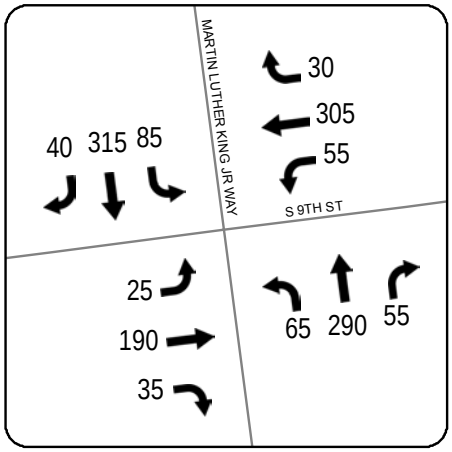
15 MLK Jr. Way & S 6th Ave

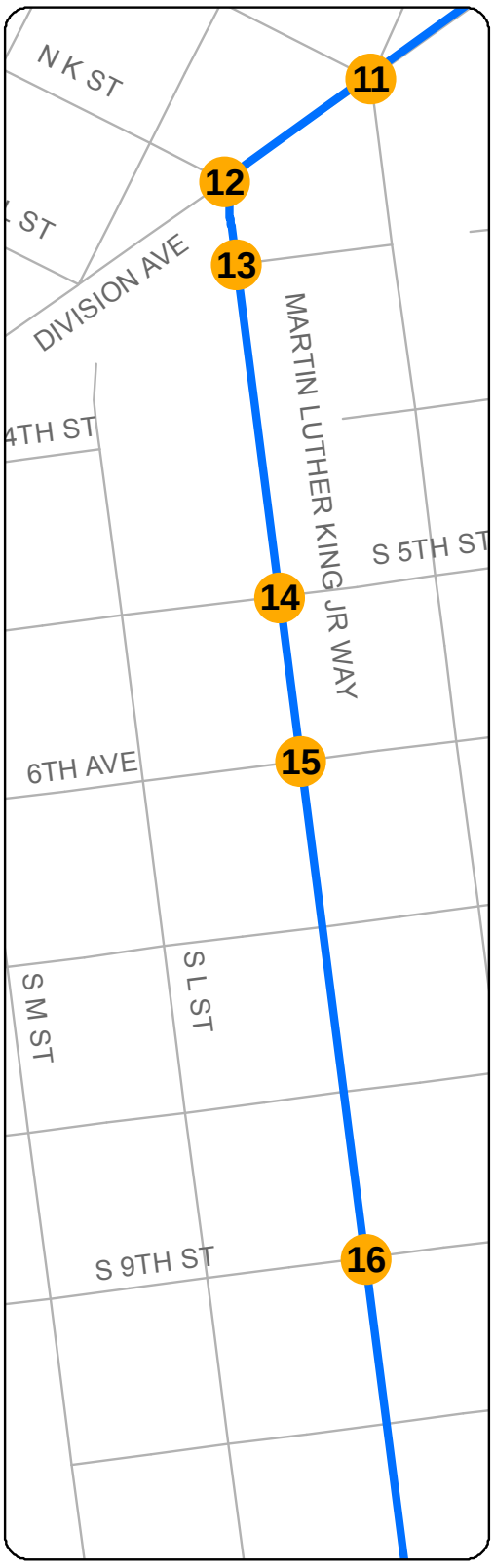


13 MLK Jr. Way & S 3rd St



16 MLK Jr. Way & S 9th St





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 100 200 400 Feet

Data Source:
CH2M HILL (2014)

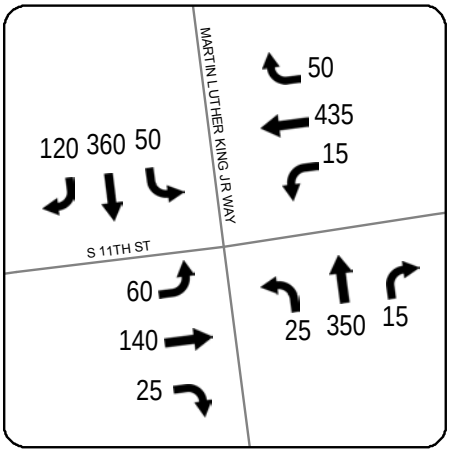
SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

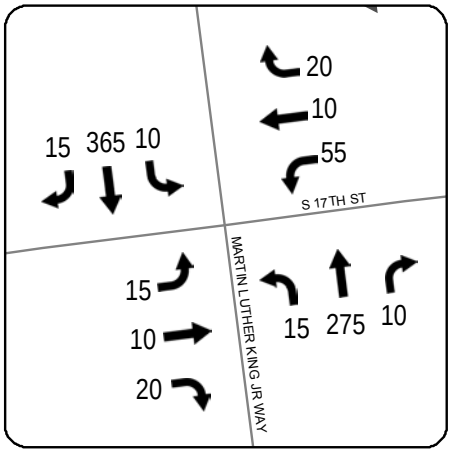
2035 NO BUILD & BUILD PM PEAK HOUR TRAFFIC VOLUMES

EXHIBIT 5-5

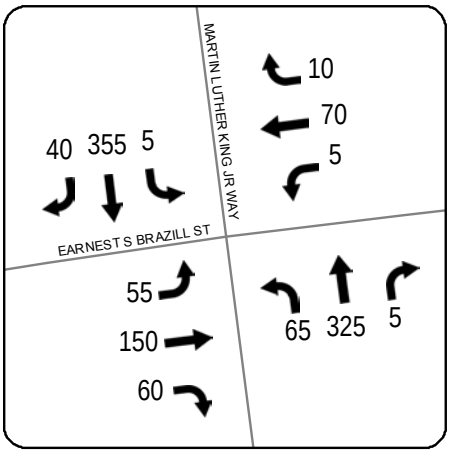
17 MLK Jr. Way & S 11th St



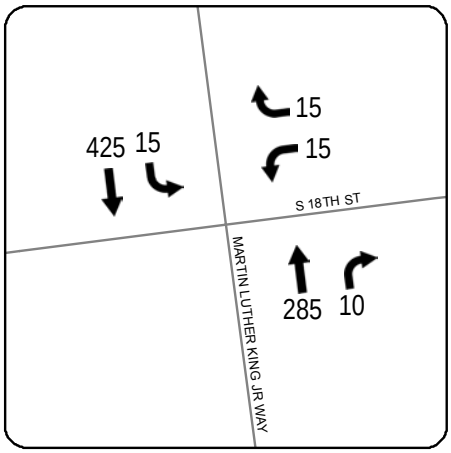
20 MLK Jr. Way & S 17th St



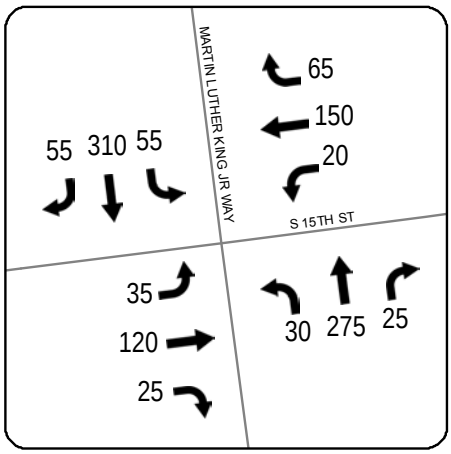
18 MLK Jr. Way & Earnest S Brazill



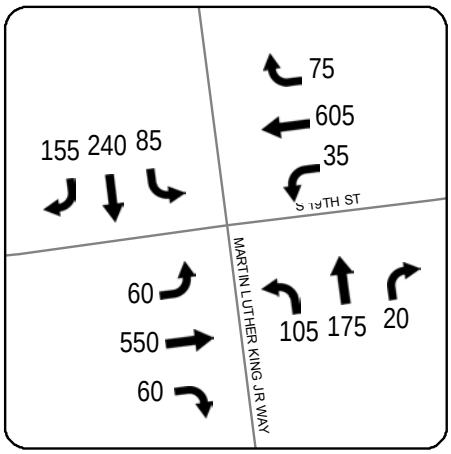
21 MLK Jr. Way & S 18th St

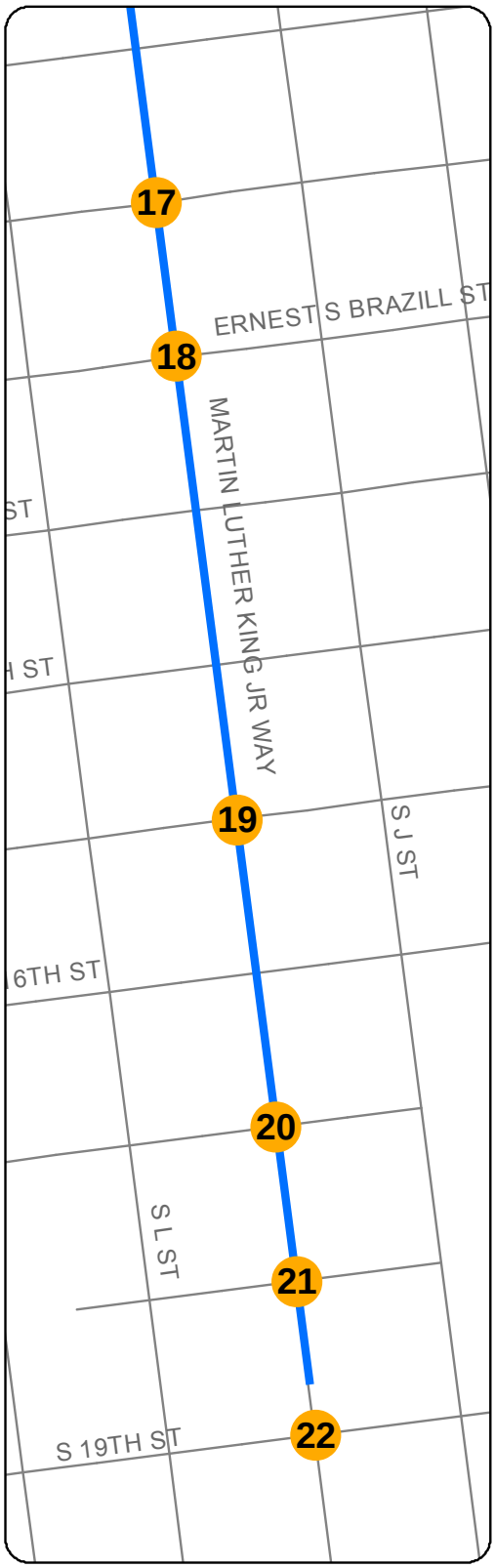


19 MLK Jr. Way & S 15th St



22 MLK Jr. Way & S 19th St





Legend

- Existing Alignment
- Proposed Alignment
- Study Intersections
- PM Peak Hour volume (veh/hr)

0 100 200 400 Feet

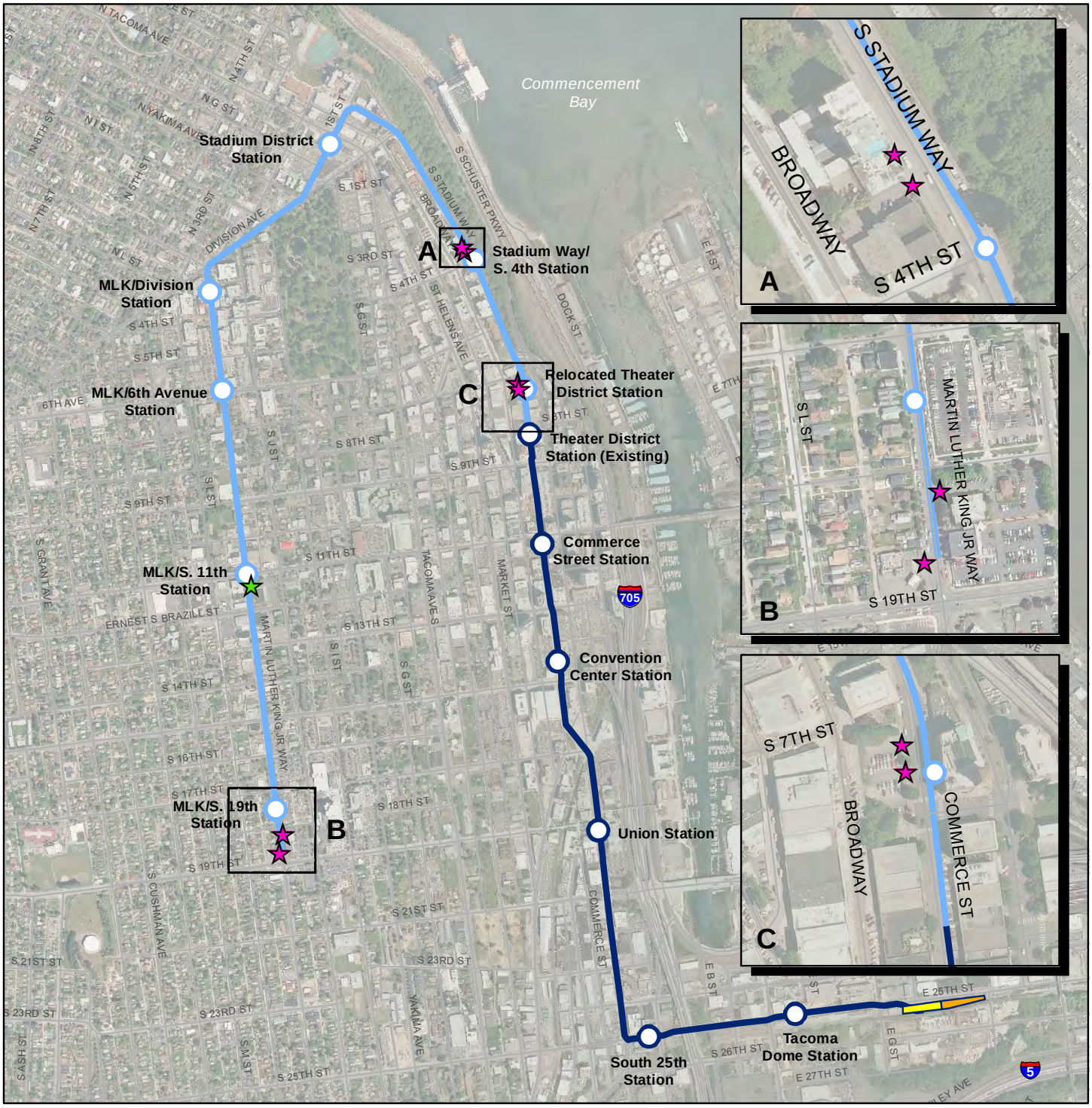
Data Source:
CH2M HILL (2014)

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

DRIVEWAY IMPACTS

EXHIBIT 5-6



Legend

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Existing Operations and Maintenance Facility
- Proposed Operations and Maintenance Facility Expansion Site

0 0.125 0.25 0.5 Miles

Driveways Impacts

- Driveway Relocation/Consolidation
- Right-In/Right-Out

SOUNDTRANSIT RIDE THE WAVE

5.3.3 Intersection Operations and Level of Service

An intersection LOS analysis was conducted for the No Build and TLE Build Alternatives at the same study intersections identified in Section 2. For the Year 2035 Build Alternative, the reported intersection LOS is a weighted average without and with the Tacoma Link vehicle operating within the intersection. The LOS methodology is described in further detail in Appendix B. LOS results are shown in Exhibit 5-7. Intersections that have at least one approach operating at LOS E or worse in either scenario are shown in Table 5-7.

TABLE 5-7
Year 2035 No Build and Build PM Peak-hour Intersection Level of Service

Intersection	Intersection Control	Year 2035 No Build					Year 2035 Build				
		Intersection LOS [a]	Approach Level of Service				Intersection LOS [a]	Approach Level of Service			
			EB	WB	NB	SB		EB	WB	NB	SB
Stadium Way/Division Avenue	Unsignalized	E	E	-	A	A	E	E	-	A	A
N 1st Street/N Tacoma Avenue	Signalized	D	C	D	D	D	D	D	D	C	E
Division Avenue/I Street	Signalized	B	B	B	C	C	C	B	B	D	E

Notes:
[a] Unsignalized LOS is reported for the worst intersection movement, normally the stop-controlled, left-turn movement.

EB = eastbound
LOS = level of service
NB = northbound
SB = southbound
WB = westbound

All study intersections are expected to operate at LOS E or better with the TLE, meeting the City of Tacoma adopted standards. At study intersections, the overall intersection LOS would remain constant between No Build and the TLE Build Alternative. Intersection approaches that do not serve the Tacoma Link vehicle would generally operate worse because they would have shorter signal green time. On average, the Tacoma Link vehicle would trigger TSP at signalized intersections. When that occurs, green time allocated to side streets will be transferred to the Tacoma Link vehicle movement; therefore, side street movements will have less green time, and delays will likely increase on these side street approaches.

As described above in Section 2.4, TSP could be implemented at any or all signalized study intersections. For the purpose of the traffic analysis, TSP was assumed; however, final implementation would be determined as design progresses.

TSP favors Tacoma Link vehicle movements, including automobile modes traveling with the Tacoma Link vehicle; therefore, non-Tacoma Link vehicle phases would incur more vehicle delay, while phases that serve the Tacoma Link would operate better than the No Build Alternative. For example, at N 1st Street/N Tacoma Avenue, when an inbound Tacoma Link vehicle arrives, the southbound approach would have less green time and may not serve all vehicles in one cycle for this approach.

TACOMA LINK EXPANSION

2035 NO BUILD AND BUILD: PM PEAK HOUR LEVEL OF SERVICE (LOS)

EXHIBIT 5-7

LEGEND

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment

2035 Intersection LOS

Signalized	Unsignalized
A - D	
E	
F	

Unsignalized

2035 No Build — 2035 Build

Signalized

0 0.125 0.25 0.5 Miles

Note: The intersections of MLK Jr./S. 17th St. and MLK Jr./S 18th St. are unsignalized in the No Build Alternative.

SOUNDTRANSIT RIDE THE WAVE

On average, during the PM peak hour, this approach would operate at LOS E. Table 5-8 and Table 5-9 show the expected operations in the inbound and outbound travel directions with the Tacoma Link vehicle present with and without TSP at each signalized intersection along the alignment. It should be noted that these tables document LOS and delay by movement and only with the Tacoma Link vehicle present. All movements that serve the Tacoma Link vehicle would operate at LOS D or better.

TABLE 5-8
Year 2035 No Build and Build PM Peak-Hour Transit Signal Priority Delay – Inbound Tacoma Link Vehicle

ID	Intersection	Lane Group	Build - No TSP		Build - With TSP		Delay Savings (seconds per vehicle)
			LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)	
3	Stadium Way/I-705 Ramps	SBT	A	5	A	3	2
4	Stadium Way/4th Street	SBT	B	10	A	10	1
8	1st Street/N Tacoma Ave	NBT	D	40	C	23	17
9	1st Street/Division Ave	EBL	C	24	C	21	2
10	Division Avenue/I Street	EXC Phase	C	33	C	24	9
12	Division Avenue/MLK Jr. Way	NBT/R	B	12	B	10	2
15	MLK Jr. Way/ 6th Avenue	NBT/R	C	28	C	28	1
16	MLK Jr. Way/ S 9th Street	NBT/R	B	16	B	15	2
17	MLK Jr. Way/ S 11th Street	NBT/R	B	15	A	7	8
18	MLK Jr. Way/ Earnest S Brazill	NBT/R	B	20	A	7	14
19	MLK Jr. Way/ S 15th Street	NBT/R	C	30	A	1	28
28	MLK Jr. Way/ S 17th Street	NBT/R	B	14	B	12	2
27	MLK Jr. Way/ S 18th Street	NBT/R	A	4	A	4	0
Total Delay Savings							**88**

Notes:
EBL = Eastbound left
EXC = Exclusive
LOS = Level of service
NBT = Northbound through
NBT/R = Northbound shared through right
SBT = Southbound through
TSP = Transit signal priority

TABLE 5-9
Year 2035 No Build and Build PM Peak-hour Transit Signal Priority Delay – Outbound Tacoma Link Vehicle

ID	Intersection	Lane Group	Build - No TSP		Build - With TSP		Delay Savings (seconds per vehicle)
			LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)	
3	Stadium Way/I-705 Ramps	NBT/R	D	41	B	18	23
4	Stadium Way/4th Street	NBT	B	12	B	11	1
8	1st Street/N Tacoma Ave	SBT	D	53	D	43	10
9	1st Street/Division Ave	SBR	C	23	C	23	0

TABLE 5-9
Year 2035 No Build and Build PM Peak-hour Transit Signal Priority Delay – Outbound Tacoma Link Vehicle

ID	Intersection	Lane Group	Build - No TSP		Build - With TSP		Delay Savings (seconds per vehicle)
			LOS	Delay (seconds per vehicle)	LOS	Delay (seconds per vehicle)	
10	Division Avenue/I Street	WBT	B	17	B	13	4
12	Division Avenue/MLK Jr. Way	SWL	A	8	A	8	0
15	MLK Jr. Way/ 6th Avenue	SBT/R	C	30	C	30	0
16	MLK Jr. Way/ S 9th Street	SBT/R	C	26	B	15	11
17	MLK Jr. Way/ S 11th Street	SBT/R	C	21	A	9	11
18	MLK Jr. Way/ Earnest S Brazill	SBT/R	A	9	A	5	4
19	MLK Jr. Way/ S 15th Street	SBT/R	A	5	A	5	1
28	MLK Jr. Way/ S 17th Street	SBT/R	A	6	A	4	2
27	MLK Jr. Way/ S 18th Street	SBT	A	4	A	4	0
Total Delay Savings							**67**

Notes:
LOS = Level of service
NBT = Northbound through
NBT/R = Northbound shared through right
SBR = Southbound right
SBT = Southbound through
SBT/R = Southbound shared through right
SWL = Southwest left
TSP = Transit signal priority
WBT = Westbound through

Other intersections, such as Division Avenue/I Street, would require an exclusive Tacoma Link vehicle phase, which removes signal green time from other vehicle movements. As a result, overall intersection and approach operations would degrade to serve the Tacoma Link vehicle. At this particular location, green time would be removed from the northbound and southbound side streets, resulting in higher vehicle delays when a Tacoma Link vehicle is present.

The Commerce Street/9th Street intersection would operate better than the No Build Alternative. The project design would remove the exclusive inbound Tacoma Link vehicle phase at this intersection, improving overall intersection efficiency, operation and traffic progression.

5.3.4 Station and Intersection Queuing

5.3.4.1 Station Area Queueing

Stations were analyzed in the PM peak hour to assess vehicle queue lengths immediately after a Tacoma Link vehicle releases from a station. An assessment of available storage at each station and the predicted 95th percentile vehicle queue lengths were analyzed. Table 5-10 shows the available storage and 95th percentile queue length at each station.

At two stations when the Tacoma Link vehicle would be stopped, 95th percentile vehicle queues lengths would exceed available storage. At the Stadium Way and S 4th Street outbound station, the queue is expected to spill back from the station. While provisions would be in place to prevent vehicles from getting trapped in the Stadium Way/S 4th Street intersection, a queue would form at the intersection stop bar and spill back into the midblock pedestrian crossing south of the intersection.

TABLE 5-10
Year 2035 Station Area Queue Lengths

Station	Direction	Available Storage (feet)	95th Percentile Queue Length (feet)
Relocated Theater District Station	Inbound [a]	110	100
	Outbound	90	60
Stadium Way and S 4th Street	Inbound	1,500	420
	Outbound [b]	335	550
Stadium District	Inbound [c]	130	120
	Outbound	180	180
MLK Jr. Way and Division	Inbound	230	120
	Outbound	220	70
MLK Jr. Way and 6th Avenue	Inbound	280	120
	Outbound	270	120
MLK Jr. Way and S 11th Street	Inbound	300	190
	Outbound	240	290
MLK Jr. Way and S 19th Street	Inbound	N/A	0
	Outbound	260	210

Notes:
Inbound = toward Tacoma Dome Station.
Outbound = away from Tacoma Dome Station.
Queue lengths that exceed available storage are highlighted in gray.

[a] Distance measured to I-705 intersection
[b] Distance measured to upstream crosswalk south of 4th Avenue and Stadium Way intersection.
[c] Distance measured to G Street crosswalk.

Vehicle queues are also likely to exceed available storage at the MLK Jr. Way and S 11th Street outbound station. This queue would spill back past 10th Street, occasionally blocking this unsignalized intersection.

5.3.4.2 Intersection Queueing

Queue lengths at intersections were assessed for the No Build Alternative and with the TLE Build Alternative. Available storage lengths and the predicted 95th percentile queue lengths are provided in Appendix C. In general, vehicle queue lengths would be similar with and without the project. N 1st Street/N Tacoma Avenue and Division Avenue/I Street, would have queues that exceed available storage, generally on a side street and only when a Tacoma Link vehicle is present. Two other intersections may have some queues that exceed available storage: Division Street/MLK Jr. Way and MLK Jr. Way/S 9th Street. In both of these instances, vehicle queues may exceed available storage; however, they generally would not exceed available storage by more than two vehicles or 50 feet.

5.3.5 Traffic Safety

The safety of the transportation system for all transportation modes was assessed with the TLE Build Alternative. The conceptual design adheres to the best design practices for Tacoma Link operations and maintains City of Tacoma roadway standards to minimize the potential effects on safety. With the

TLE, some existing transportation elements would be replaced or upgraded in those areas affected by construction, including restriping faded crosswalks, providing ADA ramps at intersections and at midblock crossings along the Tacoma Link alignment, and clearly delineating travel lanes.

5.3.5.1 Pedestrian Safety

Near station areas, there would be an increase in nonmotorized activities because pedestrians would use midblock and marked crossings at intersections. The project would improve crosswalks along the alignment by restriping faded crosswalks along the alignment. Furthermore, pedestrian crossing distances would be decreased by providing curb extensions at most stations, thus reducing exposure time, reducing motorized vehicle speeds, and improving visibility between pedestrians and oncoming motorists. As required by the ADA, pedestrian curb ramps along the alignment would be upgraded to current design standards. New push buttons would meet Accessible Pedestrian Signals standards.

As mentioned in Section 2.4, the amount of green time allocated for Stadium Way traffic at the 4th Street intersection may be reduced to prevent queuing behind the Tacoma Link vehicle for the outbound travel direction. As a result, the pedestrian phase crossing 4th Street may be skipped, because not enough pedestrian crossing time could be provided, and pedestrians would have to wait for the next pedestrian phase.

5.3.5.2 Bicycle Safety

While the TLE project is designed to accommodate all modes of transportation, including bicycles, the track groove is just slightly wider than a typical bicycle tire. Therefore, bicycle wheels could get stuck in the groove if the tire were parallel with the tracks, which would lead to an increase in crashes. To minimize the potential for bicycle crashes, the Tacoma Link design utilizes best design practices for bicycle safety. The design would not preclude access to bicycles along the streetcar alignment

Parallel to MLK Jr. Way, S “J” Street is designated as a bicycle boulevard. Way-finding signage along the alignment would help direct bicyclists traveling north-south in the study area to this facility. Bicycles would not be precluded from using the roadway along the TLE route; the additional signage would direct bicycles to an adjacent designated bicycle facility. Separating modes would reduce almost all conflicts between bicycles and Tacoma Link vehicles and has been implemented successfully in other U.S. cities, such as Portland, Oregon, and Seattle’s Capitol Hill (Seattle, 2010)

The Tacoma Link design minimizes events when a bicycle must cross the tracks at less than a 60-degree angle, which is generally when a track can “catch” a bicycle wheel as described above. At locations where bicycles must cross tracks, the design would provide a clear and consistent striped route across tracks. Street markings and signage would be implemented to direct bicycles to cross the tracks at a 90-degree angle.

5.3.5.3 Motorized Vehicle Safety

At study intersections, vehicle crash rates are not expected to increase with the Tacoma Link in operation compared with the No Build Alternative. New intersection signal phases for the Tacoma Link vehicle would be protected (refer to Table 2.2). At locations where the vehicle crosses from an exclusive right-of-way to mixed-flow traffic, signal indications are provided to remove the potential for

any vehicle crossing conflicts with the vehicle. This includes restricting opposing left-turns by adding a red arrow and restricting right turn on red movements that conflict with the vehicle.

New signals would be provided at MLK Jr. Way/ S 17th Street and MLK Jr. Way/S 18th Street. Introducing a signal would minimize conflicts with Tacoma Link vehicles crossing from an exclusive to a mixed right-of-way. At MLK Jr. Way/ S 18th Street, the signal would protect motorized vehicles from potential sight distance concerns when a Tacoma Link vehicle is dwelling in the tailtrack south of the intersection.

The potential for an increase or decrease in collisions at intersections could occur with geometric and operational modifications. The *Highway Safety Manual* (AASHTO, 2010) provides crash modification factors (CMFs) that can be used to quantify what change in crash potential could occur. The manual states that providing a protected phase could reduce the number of crashes at an intersection by approximately 1 percent. If a stop-controlled intersection is converted to a traffic signal, as is recommended along MLK Jr. Way at the 17th Street and 18th Street intersections, the potential for crashes could be reduced by approximately 20 percent. Both of these intersections have low existing crash rates. No or minimal change would be expected for locations where an exclusive Tacoma Link vehicle phase is warranted. At Commerce Street and 7th Street, converting the existing all-way stop control to a one-way stop control could result in an increase in crashes. Although this location has the highest existing crash rate of the study intersections, no crashes have occurred since Commerce Street was under construction (October 2012).

The alignment would travel through several unsignalized intersections, and vehicle crash rates are not expected to increase at these intersections. Several streetcar systems in the U.S., including the South Lake Union streetcar in Seattle, Washington, and the North South Line in Portland, Oregon, currently operate streetcars through unsignalized intersections. In both of these examples, similar characteristics (on-street parking, high pedestrian volumes, and an urban environment) at unsignalized intersections would be present with the Tacoma Link Expansion. The Tacoma Link Expansion would be designed to have sufficient sight distance, which may include removing some adjacent on-street parking, to allow side street vehicles to safely cross the tracks.

On N 1st Street, existing pull-in parking would be converted to back-in parking. Back-in angle parking is generally deemed safer than pull-in angle parking because motorists have an easier time seeing the Tacoma Link vehicle when leaving the parking stall. Similar systems in other cities, including Tucson, Arizona, and Kansas City, Missouri have converted parking to improve safety.

5.4 Parking

The TLE project does not add or expand any park-and-ride facilities. Near most stations, there is a large amount of unrestricted on-street parking; however, the potential for hide-and-ride parking would be similar to bus routes and should be minimal.

Hide-and-Ride

This activity occurs when transit users park in neighborhoods surrounding transit stations.

At most station platforms, and at other locations along the alignment, on-street parking would be permanently removed with TLE project completion. As design of the TLE moves forward, there may be opportunities to reduce the number of parking spaces removed through modifying the design or minimizing the amount of exclusive trackway. A parking assessment was completed based on the conceptual engineering plans. The parking removal is currently an estimate and may change during preliminary and final design. Table 5-11 shows the parking that would potentially be removed and added with the project, and the current AM and PM peak-period utilization on the block face where parking would be removed. Exhibit 5-8 shows where the TLE would impact parking and identifies block faces with high parking utilization. Approximately 50 parking spaces would be removed along the entire 2.4-mile expansion. The existing Theater District Station would be converted to approximately nine parallel parking spaces. Most removed parking spaces would be located in two areas. The MLK and S 19th Street Station would remove 20 unrestricted on-street parking spaces along the east side of MLK Jr. Way between 17th and 19th Streets. Ten unrestricted on-street parking spaces would also be removed along the south side of Division Street between MLK. Jr. Way and N "I" Street as a result of the exclusive Tacoma Link Expansion travel lane.

Each station platform would remove up to four on-street parking spaces, except the 19th Street Station and the Relocated Theater District Station. The median station platform located at Stadium Way/S 4th Street would not impact any nearby on-street parking. The inbound and outbound platforms located near MLK Jr. Way/Division would remove approximately four disabled parking spaces in front of Tacoma General Hospital. Along MLK Jr. Way, if existing Pierce Transit stops are no longer required, then two bus stops could be converted to parking, which would add about four new parking spaces per bus stop.

Parking utilization rates vary throughout the study area. Several segments and station areas would remove parking on blocks that have utilization rates in excess of 80 percent during the AM and/or PM peak period. On-street parking near Tacoma General Hospital and St Joseph's Hospital has the highest existing parking utilization rates, and three stations, MLK and S 3rd Street, MLK and 6th Avenue, and MLK and S 19th Street, would remove parking near these facilities. Despite the high parking utilization rates where the project would remove parking, there is generally underutilized available on-street parking located within one to two blocks of each station area, as well as parking garages for the hospitals that provide validated and free parking for patients and visitors. Refer to Section 7, for information on parking mitigation.

Adjacent to the inbound alignment between N "G" Street and N Tacoma Avenue, 10 pull-in angle parking spaces would be converted to 10 back-in angled parking spaces. This conversion would allow drivers more visibility to leave the parking space, reducing the potential for a conflict with a Tacoma Link vehicle.

TABLE 5-11
Tacoma Link Expansion Estimated Parking Space Removal and Utilization

Parking Area/Station	Station/Segment	Total Parking Change (spaces)	Percent Utilization		Notes
			AM Peak Period (7 a.m. to 10 a.m.)	PM Peak Period (3 p.m. to 6 p.m.)	
Outbound					
Commerce Street between 9th Street and Proposed Theater District Station	Segment	+7	30	90	Existing Theater District Station would be removed and converted into parallel parking (approximately nine spaces). Angle parking south of 7th Street would be converted to parallel parking (loss of approximately two spaces)
Relocated Theater District [a]	Station	-6	Less than 5	10	Back-in angle parking would be converted to parallel parking (loss of approximately six spaces)
Between Stadium District Station and 1st Street/Division Avenue Intersection	Segment	-2	65	40	
MLK and S 3rd Street	Station	-1	85	85	
MLK and 6th Avenue	Station	-4	95	25	
MLK and S 11th Street	Station	-4	10	95	
Inbound					
MLK and S 18th Street	Station	-20	95	>95	
MLK and S 11th Street	Station	-3	40	40	
MLK and 6th Avenue	Station	-4	More than 95	75	
MLK and S 3rd Street	Station	-3	90	95	
Between 3rd Street Station and 1st Street/Division Intersection	Segment	-10	More than 95	50	
Between 1st Street/Division Avenue Intersection and Stadium District Station	Segment	0	90	55	10 angle parking spaces would be converted to 10 back-in angled parking spaces.
Total	**All**	**-50**	**-**	**-**	

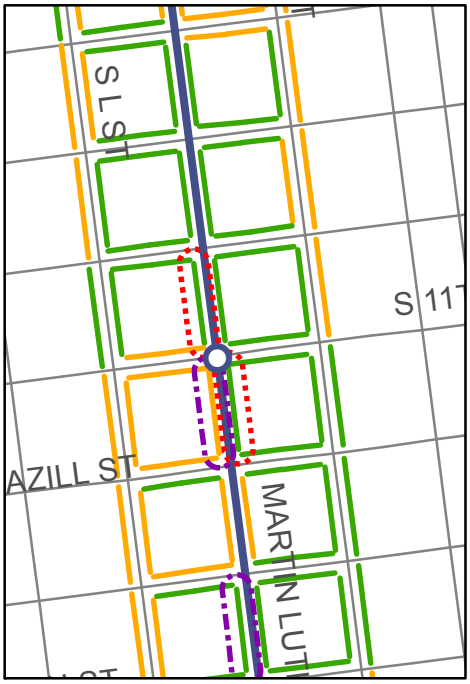
Notes:
Inbound = toward Tacoma Dome Station; outbound = away from Tacoma Dome Station.
Utilization percentages are rounded up to the nearest 5.

TACOMA LINK EXPANSION

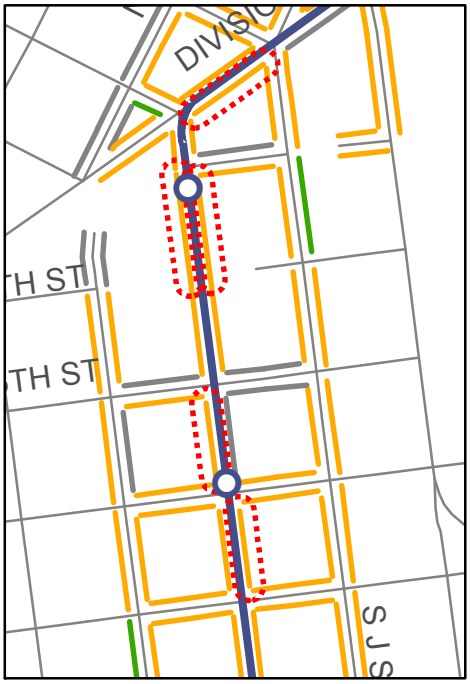
POTENTIAL FUTURE ON-STREET PARKING IMPACTS

EXHIBIT 5-8

MLK/S. 11th Station

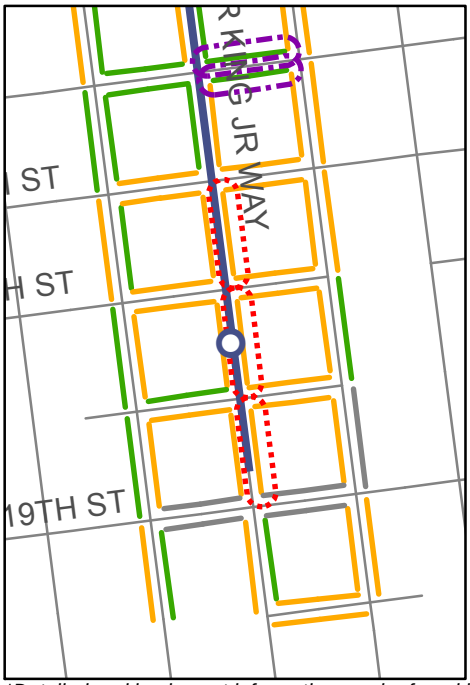


MLK/S. 6th Ave & MLK/Division Stations

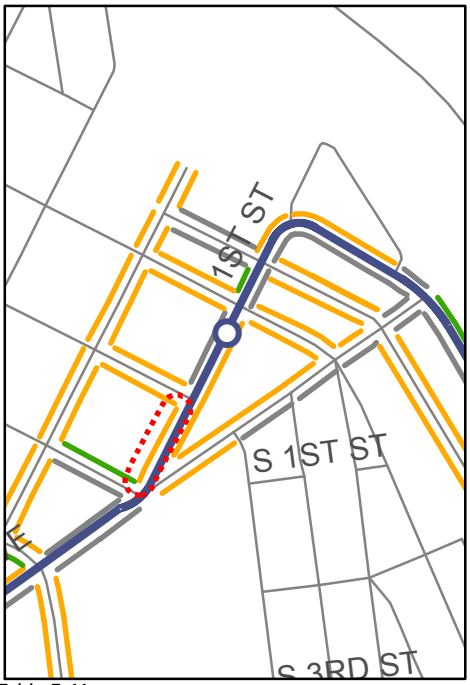


Stadium Way/S. 4th Station

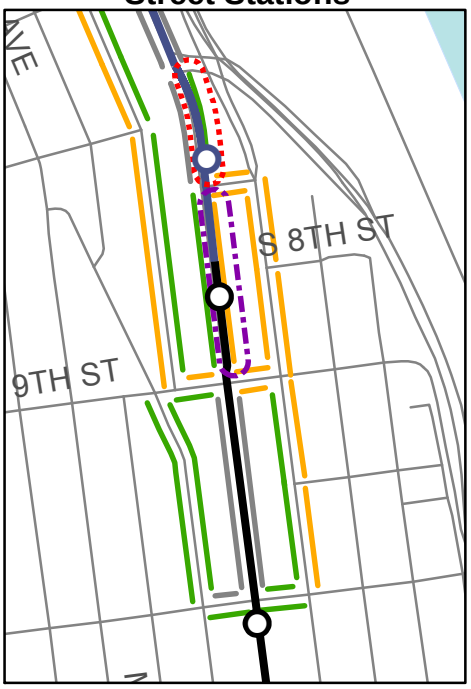
MLK/S. 19th Station



Stadium District Station



Theater District & Commerce Street Stations



**Detailed parking impact information can be found in Table 5-11*

0 0.05 0.1 0.2 Miles

Legend

- Existing Stations
- ProposedStations
- Existing Alignment
- Proposed Alignment

On-Street Parking Utilization

- No Parking
- Lower Use (0 - 50%)
- Higher Use (51 - 100%)

Parking Impacts*

- Gain
- Loss

Notes:
-Utilizations shown may be AM or PM depending on which one is higher. The highest utilization rate is shown.
-Some gains are due to potential changes in transit routing. Additional coordination with Pierce County may be required.

Source: CH2M HILL, 2014

Date: 1/20/2015

SOUNDTRANSIT RIDE THE WAVE

As shown in Exhibit 5-1, several transit routes would be shifted from MLK Jr. Way onto parallel streets. Pierce Transit Route 57 is the only bus route that currently serves MLK Jr. Way between 9th and 15th Streets. With this route shifted to S "J" Street, several transit stops along MLK Jr. Way and 15th Avenue could be converted to unrestricted on-street parallel parking.

5.5 Nonmotorized Facilities

5.5.1 Pedestrian and Regional Trail Facilities

Currently there are sidewalks present on most all public rights-of-way through the study area. The proposed pedestrian facilities improvements would maintain and/or enhance sidewalks and crosswalks. No sidewalks would be removed, and nearly all sidewalks would remain the same width as their current configuration and side platform locations would expand the pedestrian area. All existing crosswalks would remain in place.

5.5.2 Bicycle Facilities

Exhibit 5-9 identifies the existing and proposed bicycle facilities in the transportation study area. "J" Street, which is one block east of MLK Jr. Way, is proposed as a bicycle boulevard and would serve as the main north-south bicycle thoroughfare. Other new bicycle facilities are planned on east-west routes that bisect the study area. Bicycles are allowed on Tacoma Link vehicles, facilitating combined bike and transit trips.

5.5.3 Walksheds and Bikesheds

The nonmotorized facilities were inventoried and evaluated for a walkshed of 0.25 mile and 0.50 mile and a bikeshed of 1 mile around each existing and proposed station in the downtown area, assuming the actual walk or bicycle distance on local facilities from the station platform. This area reflects the potential population and employment base that could directly access the light rail system without requiring motorized travel. The availability of sidewalks and nonmotorized use trails were considered for the walkshed analysis, while streets were also considered in the bikeshed analysis.

Walksheds and Bikesheds

Walksheds and bikesheds are walkable and bikeable, respectively, areas around particular points of interest. For the TLE stations, a walkshed is defined as a 0.25- or 0.50-mile actual walk distance, while a bikeshed is defined as a 1-mile bike distance via streets and nonmotorized use trails to a station.

The absence of nonmotorized facilities or the presence of major geographic barriers affects how much area can be covered with a 0.50-mile walk or 1-mile bike ride from each station. Other natural barriers, such as topography, were not included as part of the walkshed and bikeshed analysis. However, they could make nonmotorized travel less attractive.

TACOMA LINK EXPANSION

EXISTING AND FUTURE REGIONAL TRAILS AND BICYCLE FACILITIES

EXHIBIT 5-9

Legend

- Existing Stations
- Proposed Stations
- Existing Alignment
- Proposed Alignment
- Existing Bicycle Lane
- Existing Marked Shared Lane
- Existing Trail
- Planned Trail
- Future Bicycle Boulevard
- Future Bicycle Lane
- Future Cycle Track
- Future Shared Lane Marking

0 0.125 0.25 0.5 Miles

Data Source:
City of Tacoma GIS updated by CH2M HILL (2014).

SOUNDTRANSIT RIDE THE WAVE

Exhibit 5-10 shows the 0.25-mile and 0.50-mile walksheds. The walksheds in the exhibit display that all the station locations would be within 0.25-mile walk distance between any two of the stations and established pedestrian facilities along the corridor are well connected. The walksheds also shows that the pedestrians in the Tacoma downtown area would have access to the proposed TLE stations within a maximum of 0.50-mile walk distance.

Exhibit 5-11 shows the 1-mile bikesheds. The bikesheds in the exhibit demonstrate that all the station locations would be within 1 mile bikeable distance between any two of the stations along the corridor. The bikesheds also shows that TLE stations would be accessible from all of downtown Tacoma to neighborhoods west of Sprague Avenue.

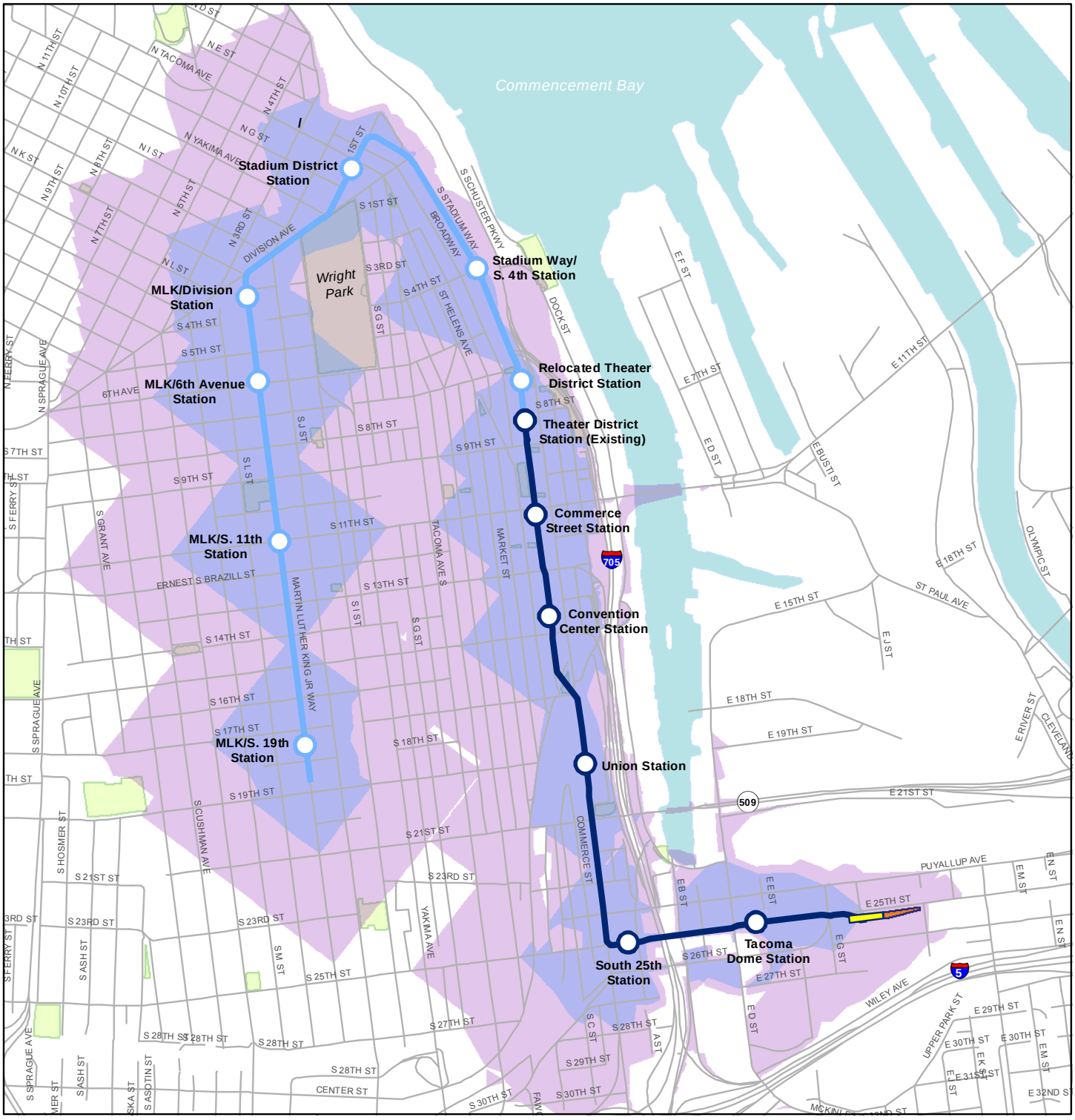
5.6 Freight Mobility and Access

No substantial changes to freight mobility and access are expected with the TLE. Truck traffic would still be expected to use the currently designated freight facilities for moving freight. The distribution of trucks in the study area would be similar to the No Build Alternative described in 5.3.2.

TACOMA LINK EXPANSION

TACOMA LINK EXTENSION STATION AREA WALK SHEDS

EXHIBIT 5-10



LEGEND

- Proposed Stations
- Existing Stations
- Existing Alignment
- Proposed Alignment
- Existing Operations and Maintenance Facility Site
- Proposed Operations and Maintenance Facility Expansion Site
- Parks
- Walk Shed within 1/4 mile
- Walk Shed within 1/2 mile

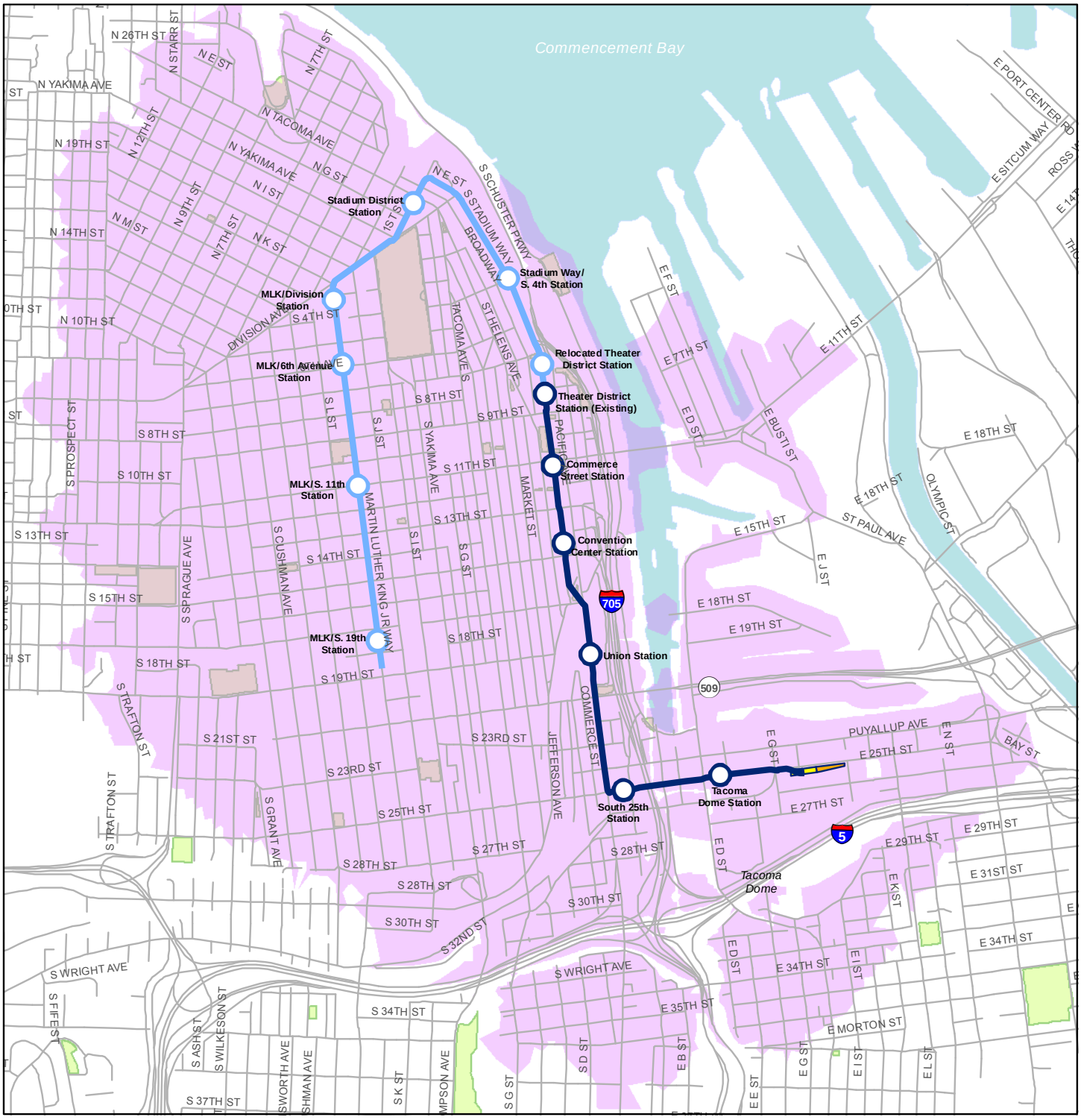
0 0.125 0.25 0.5 Miles

SOUNDTRANSIT RIDE THE WAVE

TACOMA LINK EXPANSION

TACOMA LINK EXTENSION STATION AREA BICYCLE SHEDS

EXHIBIT 5-11



LEGEND

- Proposed Stations
- Existing Stations
- Existing Alignment
- Proposed Alignment
- Existing Operations and Maintenance Facility Site
- Proposed Operations and Maintenance Facility Expansion Site
- Bike Shed
- Parks

0 0.25 0.5 1 Miles

SOUNDTRANSIT RIDE THE WAVE

6.0 Construction

This section discusses and compares potential transportation mobility impacts that would be caused by TLE construction. TLE construction activities would include civil construction, systems installation, testing, and startup activities. Civil construction would include site preparation as well the construction of the physical infrastructure.

6.1 Construction Duration and Phasing

Constructing the TLE would result in temporary impacts on roadways, transit, sidewalks, and parking within most construction areas. The overall construction duration would be up to 3 years; however, most impacts would occur during the civil construction period and not all construction impacts would occur in the same area for the entire construction duration

For the TLE, construction would likely be staged and occur in work zones approximately 4 to 8 blocks in length (0.25 to 0.5 mile). Construction duration within this four- to eight-block area is anticipated to last about 4 to 6 weeks, depending on the extent of the utility relocations and street improvements required. Track construction would typically proceed with a single direction of track, limiting the impact to transportation in the corridor to one direction at one time. Construction activities may occur at different locations along the alignment at any given time.

Demolishing and removing existing pavement would require larger construction equipment. The preparation of the track bed, setting ties, rails, and welding track segments would use smaller equipment and impacts to the roadway, including construction area, would be less than the previous construction phase. These activities would generally be contained to the roadway median or adjacent travel lane (where applicable). Placing concrete, the last step in the process would have similar impacts as the demolishing and removing existing pavement phase.

Other activities, including platform construction and signal installation and modification, would be limited to small work area and would have minimal impacts to traffic and transit mobility.

6.2 Construction Impacts

Construction activities expected to have roadway impacts are utility relocation, roadway reconstruction, track construction, truck hauling, demolition, and construction staging.

Most construction activity would require use of half the street, keeping the other half available for traffic. On-street parking would be restricted in the construction zones. To the extent possible, at least one travel lane in each direction would be open at all times during construction along MLK Jr. Way. Stadium Way would be reduced to one lane. When only a single lane of traffic is open, flagging operations would be in place to guide motorists through the work zone. In addition to flagging operations, signed detour routes could be provided to minimize traffic through the construction area. Table 6-1, lists potential traffic detour routes that could be implemented as needed during construction.

TABLE 6-1
Potential Traffic Detour Routes

Roadway Segment	Potential Detour Route(s)
Commerce Street/Stadium Way between 9th Street and 4th Street	Broadway
South Stadium Way between 4th Street and N E Street	Broadway
N 1st Street between N E Street and Division Avenue	N 2nd Street or Division Avenue
Division Avenue between N 1st Street and MLK Jr. Way	S 6th Avenue via Tacoma Avenue S
MLK Jr. Way between Division Avenue and S 19th Street	J Street or S I Street/S Yakima Avenue

Construction could require local road closures, lane closures, traffic detours, and property access modifications and closures to maintain traffic flow. Streets that intersect the TLE would require full and/or partial closures for short durations to construct the track or other associated features. Temporary closures of private driveways for businesses and residences could also occur. If driveway closures are required, then access to these properties would be maintained to the extent possible. If alternative access to a business is not available, then the specific construction activity would be reviewed to determine whether it could occur during nonbusiness hours. A Traffic Control Plan would be developed prior to construction with information on the detour routes and would need approval from Sound Transit and the City of Tacoma.

When construction activities conflict with an existing bus stop, a temporary stop might be provided in adjacent curb space, or it may be temporarily closed. On some routes, transit travel times and reliability might be longer due to construction related activities.

Sidewalks and crosswalks would generally be maintained so pedestrians can safety walk through the construction areas. Protected sidewalks next to the construction area would be provided when pedestrian detours are not feasible. However, depending on construction activities, sidewalks or crosswalks may be temporarily closed and pedestrians would be rerouted to a nearby facility. Access through construction zone would ensure ADA accessibility.

On-street parking might be temporally closed during TLE construction. To maintain travel lanes through the construction zone, parking restrictions on both sides of the street may be necessary until construction is complete, which would be about 4 to 6 weeks. Temporary parking would be provided as needed and where feasible to mitigate construction impacts. Nearby on-street parking areas could have restrictions, such as permit only parking, or removed (if applicable) to accommodate displaced parking spaces. Additional parking mitigation during construction is described in Section 7.5.

6.3 Haul Routes

Most construction-related trips would use I-705 to access the site. Construction-related trips would use streets along the proposed alignment to access construction areas and I-705. Some trips might use east-west streets, such as S 9th Street, S 15th Street, and S 21st Street, to access MLK Jr. Way to and from I-705. A traffic management plan would be developed prior to construction which would identify

haul routes. The highest level of truck activity is anticipated during the removal of the existing pavement and placement of concrete for the trackway.

7.0 Potential Mitigation Measures

This section describes the potential mitigation measures for transportation mobility impacts caused by the TLE. Potential mitigation has been identified for intersection control, parking, and bicycle operations. No additional mitigation above what the project is providing is anticipated for regional facilities, safety, or freight mobility and access.

7.1 Transit Mitigation

The transit integration plan developed through collaboration with Pierce Transit and Sound Transit would provide coordinated bus service with the TLE. No additional transit mitigation is required.

7.2 Traffic Mitigation

All study intersections would operate at LOS E or better; therefore, no mitigation is required for the TLE. However, to improve traffic operations as discussed in Section 5.3, Arterial and Local Street Operations and Safety, and associated travel modes, including bus transit, automobile, freight, and Tacoma Link vehicle, mitigation measures could be implemented, if warranted. Improvements could include adjusting signals to provide more green time to side streets or changing signal phasing. Sound Transit and the City Tacoma would coordinate on the need for any changes and the associated costs. The following are the possible mitigation measures that could be implemented if warranted:

- **Division Avenue/S "I" Street—**Monitor transit signal priority signal timings and adjust timings to provide more green time to side streets.
- **N 1st Street/Tacoma Avenue—**Monitor transit signal priority signal timings and adjust timings to provide more green time to poorly operating approaches. Potentially remove split phasing and provide protected northbound and southbound left turns along N 1st Street. Permissive left-turns operations on N 1st Street would not be recommended due to sight distance limitations.

No other mitigation would be required for traffic operations.

7.3 Parking Mitigation

The TLE project requires removing several on-street parking spaces for station platforms and exclusive trackway sections. Measures to address loss of parking would require coordination with the City of Tacoma to determine whether replacement of on-street parking can be developed. Sound Transit and the City of Tacoma would also coordinate with the communities along the TLE alignment to understand concerns and determine what mitigation measures would work. Parking mitigation measures would include the following practices, as appropriate:

- Coordinate with City of Tacoma to implement best business practices for addressing parking impacts.

- Implement time-of-day, time-restricted and/or paid-parking restrictions to encourage parking turnover. A residential parking zones (RPZ) could also be implemented. This could include exempting a resident's vehicle from posted parking time-limit restrictions or by restricting parking to cars only with valid residential parking permits.
- Provide enforcement of existing time-of-day or time-restricted parking, in particular in north downtown Tacoma and in the Stadium District where restrictions are already in place.
- Provide enhanced signage and outreach to promote existing private parking lots. Signage would include the parking garages for the hospitals and medical clinics located along MLK Jr. Way.
- Encourage the use of underutilized on- and off-street parking.
- Where feasible, convert nearby existing on-street parallel parking to angle parking to create additional parking opportunities where parking is removed.
- Where feasible, restripe existing angle parking that exceeds width standards to match City of Tacoma standards.
- Where feasible, convert existing, on-street parallel parking on MLK Jr. Way by Tacoma Muliticare to ADA parking to replace removed ADA parking removed as a result of the MLK/Division Station platforms.
- Have Sound Transit work with employers to promote the use of alternative transportation services, including riding TLE to reduce parking demand.
- Relocate the Pierce Transit stop on the east side of MLK Jr. Way at approximately S 4th Street to one block (up to 400 feet) north, near 3rd Street, and convert vacated transit area into disabled spaces (approximately three spaces).
- During construction of the TLE, identify opportunities for long-term parking mitigation related to test strategies identified above related to time restrictions, pay parking, and signage.

For parking controls measures, Sound Transit would be responsible for the cost of installing the signage, pay stations, restriping, or other parking controls for up to 1 year. The City of Tacoma would be responsible for monitoring and providing all enforcement and maintenance.

The potential for hide-and-ride parking may exist near some stations; however, the potential is not different than that of the existing bus stops. If excessive hide-and-ride activity does occur near stations, Sound Transit, in collaboration with the City of Tacoma, would develop a plan to evaluate and, if necessary, implement mitigation strategies. This plan would involve inventorying existing on-street parking demand around each station before and after the beginning of the TLE revenue service. If bus Route 57 shifts, the bus stops on MLK Jr. Way could be converted to on-street parking which could create up to four spaces per bus stop.

Other stations would either not remove any existing on-street parking, or on-street parking adjacent to the station platforms should be able to accommodate the additional parking demand.

7.4 Nonmotorized and Bicycle Mitigation

Sound Transit would provide pedestrian and bicycle amenities at stations consistent with its System Access Policy and the Federal Transit Administration's Small Starts criteria. These amenities include benches, a transit shelter, ADA-accessible curb ramps, and a platform that would allow level access with the doors on the Tacoma Link vehicle. New or reconstructed facilities would be designed and constructed to meet agency and federal standards for pedestrian safety and mobility.

Bicycles are currently and will continue to be allowed on Tacoma Link vehicles. At locations where bicycles must cross tracks, the project would provide signage and striping to direct bicyclists and would meet design standards to ensure bicycle safety.

7.5 Construction Mitigation

Prior to construction, Sound Transit would finalize detailed construction plans in coordination with the City of Tacoma during the final design and permitting phases of the project. All mitigation measures associated with constructing the TLE would comply with local regulations governing construction traffic control and construction truck routing. Potential mitigation measures for traffic impacts during construction would include the following practices, as appropriate:

- Conform to jurisdictional agency requirements for all traffic plan maintenance.
- Use lighted or reflective signage to direct drivers to truck haul routes to ensure visibility during nighttime work hours.
- Communicate public information through tools such as print, radio, posted signs, web sites, and email to provide information regarding any required street closures, hours of construction, business access, and parking impacts. Sound Transit would provide this plan.
- Coordinate access closures with affected businesses and residents. The contractor would be required to perform this task in coordination with Sound Transit staff. If access closures are required, then property access to residences and businesses would be maintained to the extent possible. If access to the property cannot be maintained, then the specific construction activity would be reviewed to determine whether it would occur during nonbusiness hours or if the parking spaces and users of the affected access (for example, deliveries) would be provided at an alternative location.
- Provide protected sidewalks next to the construction area where possible when pedestrian detours are not feasible. Access through the construction zone would meet applicable federal, state and local regulations including the Americans with Disabilities Act (ADA).
- Provide detour, open for business, and other signage as appropriate.
- Post advance notice signs prior to construction in areas where surface construction activities would affect access to surrounding businesses.

- Provide regular updates to schools, emergency service providers, local agencies, solid waste utilities, and postal services, and assist public school officials in providing advance and ongoing notice to students and parents concerning construction activity near schools.
- Schedule traffic lane closures and high volumes of construction truck traffic during off-peak (including school peak) hours to minimize delays during periods of higher traffic volumes as much as possible.
- Cover potholes and open trenches, where possible, and use protective barriers to protect drivers from open trenches.
- Encourage contractors to lease parking lots and/or identify temporary parking areas when on-street parking is closed.

8.0 Indirect and Secondary Impacts

This section discusses indirect and secondary transportation impacts as a result of operation of the TLE. The completed TLE would provide reliable transit service between the Tacoma Done Station, Downtown Tacoma, the Stadium District, and the Hilltop neighborhoods. The TLE is anticipated to result in positive indirect impacts related to transit-oriented development near station locations, which could lead to changes in travel patterns.

At existing Tacoma Link stations, boardings would change with the TLE. At the Tacoma Dome Station, Tacoma Link vehicle boardings are expected to increase. The increase in boardings could lead to changes in travel patterns because trips to and from this station would increase for all travel modes, which could affect transit, local traffic volumes, parking demand (if applicable), and nonmotorized users. However, the small increase in activity at the Tacoma Dome would be offset by a reduction in VMT/VHT throughout the city of Tacoma as discussed in Section 5.1.1.

The TLE could also affect ridership on other transit routes within the existing Tacoma Link and TLE study area, particularly on feeder transit service. Shorter bus trips could have increases in ridership because more riders would use other transit service to access Tacoma Link. In addition to the future conceptual bus service plan assumed with the TLE, other changes in transit service within the TLE corridor that are not yet planned or anticipated could also result in shifts in ridership. For instance, if Pierce Transit bus service is restored to preservice cut levels (prior to 2008), the potential for more bus-to-rail transfers could occur, and ridership on Tacoma Link and feeder buses could change.

9.0 References

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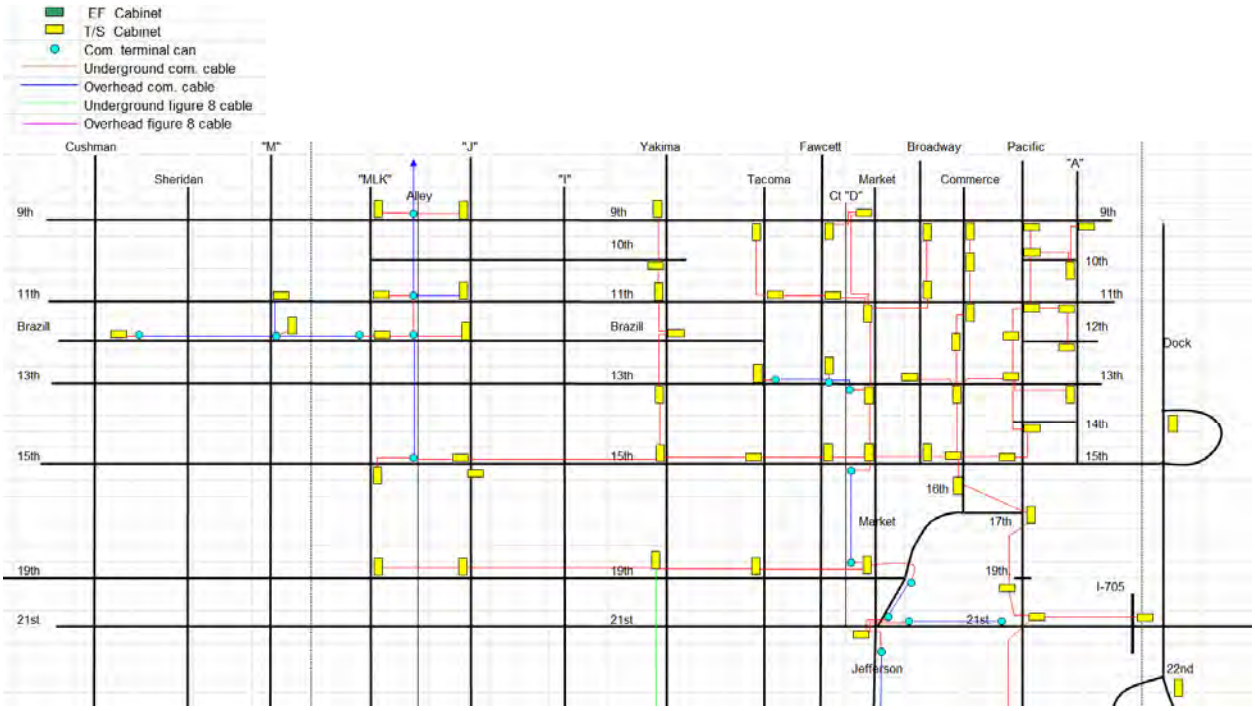
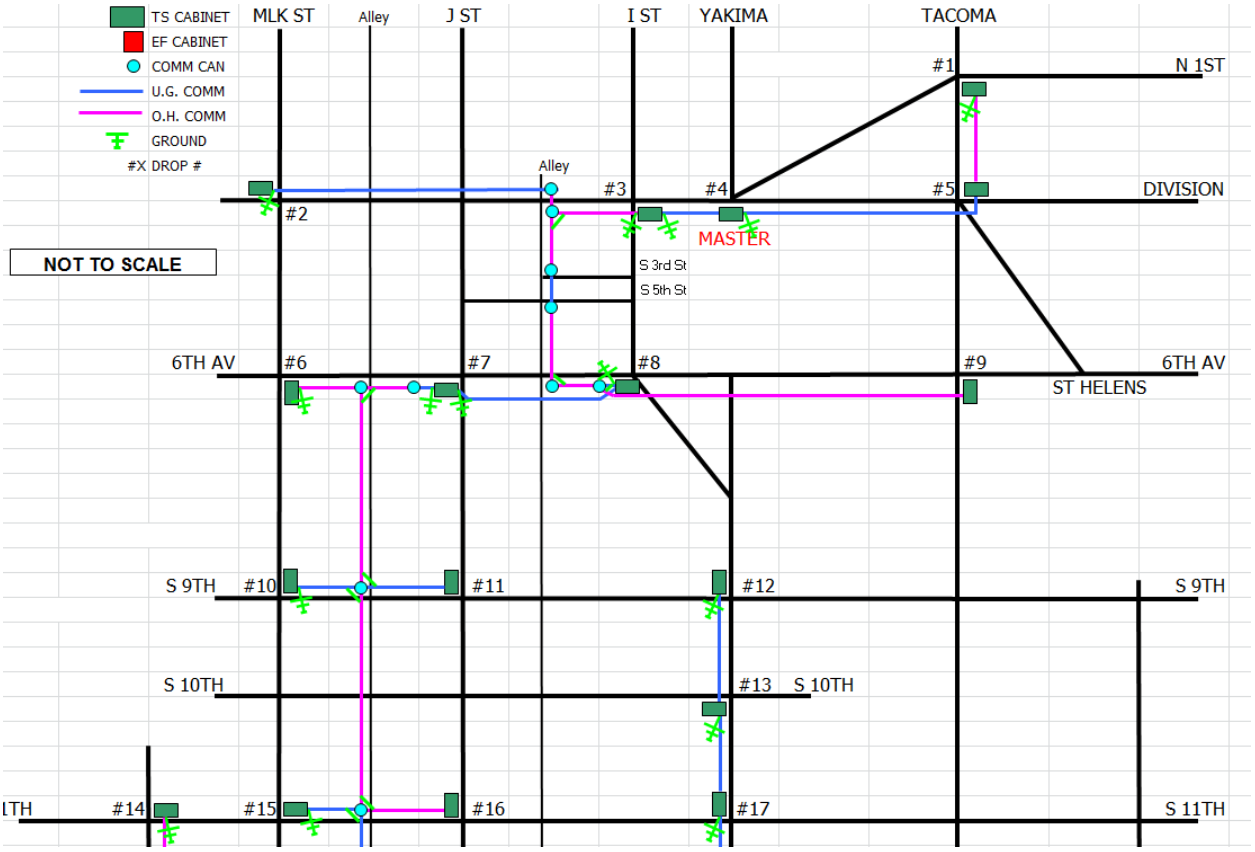
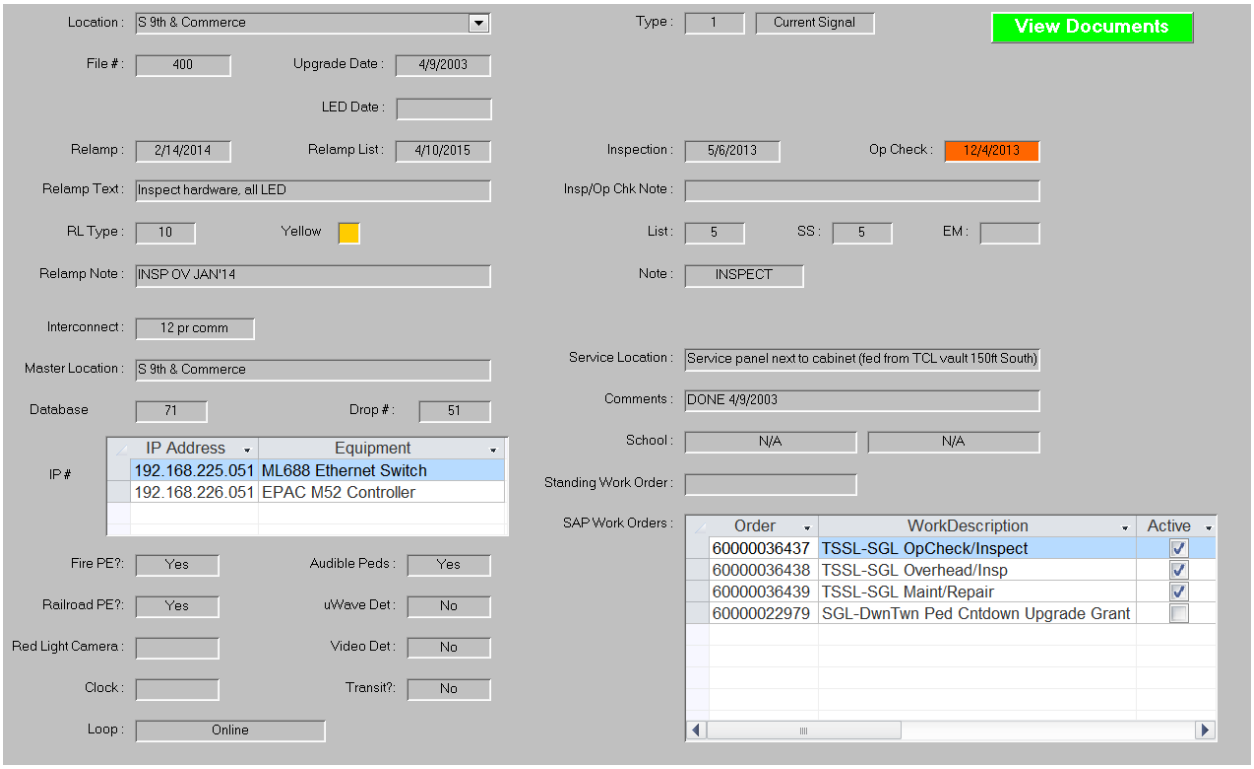
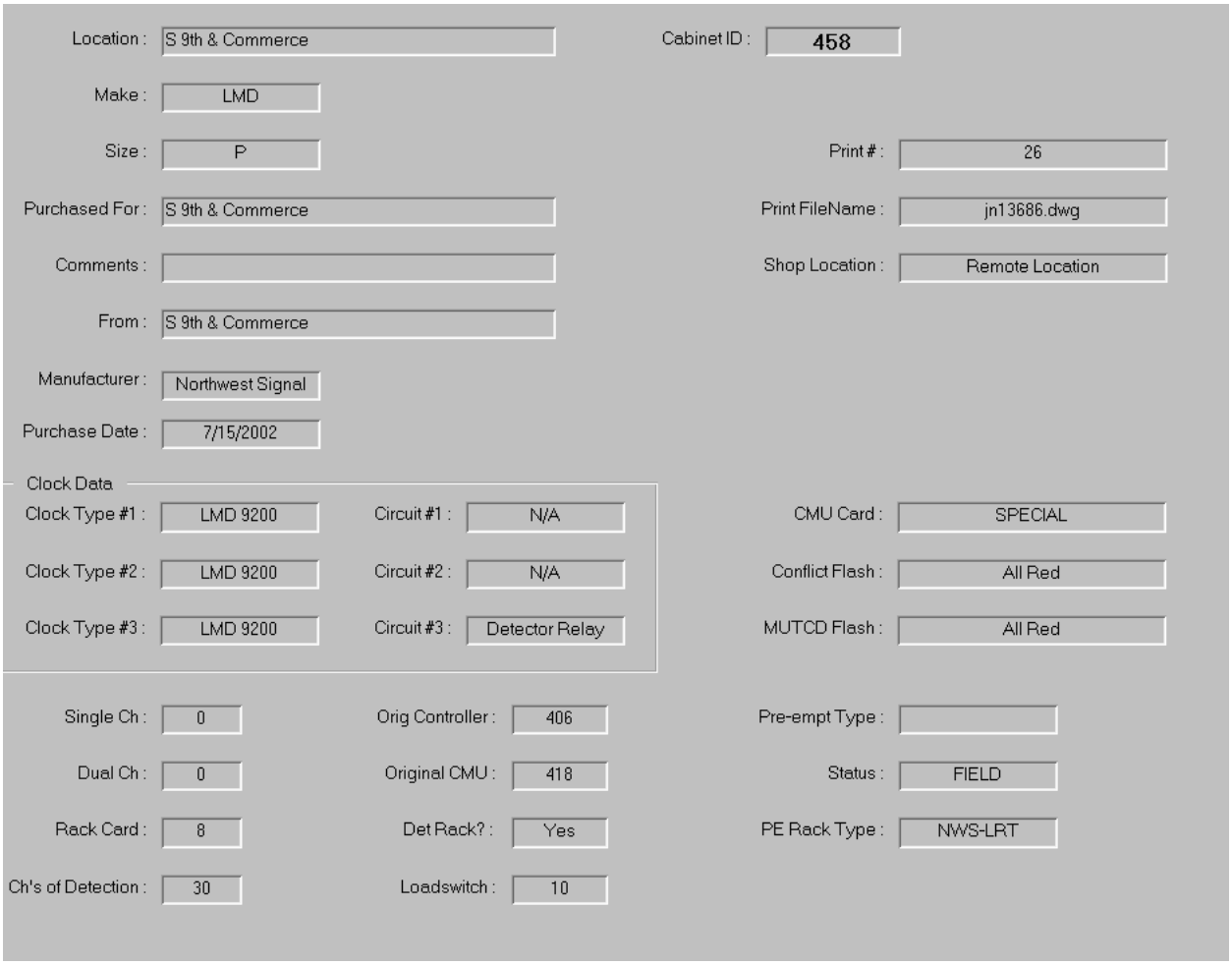
Appendix A
Signal Controller Data

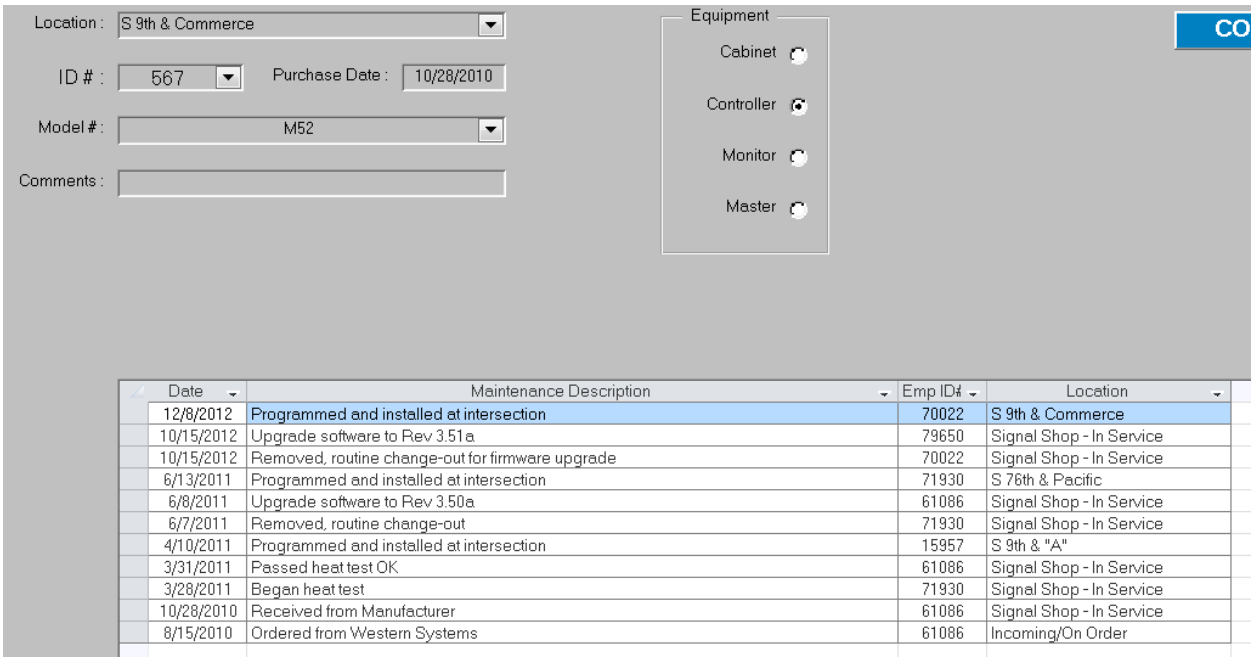

EF Cabinet
T/S Cabinet
Com terminal can
Underground com. cable
Overhead com. cable
Underground figure 8 cable
Overhead figure 8 cable
Cushman
Sheridan
"M"
"MLK"
Alley
"J"
"I"
Yakima
Tacoma
Fawcett
Market
Ct "D"
Broadway
Commerce
Pacific
"A"
Dock
I-705
Jefferson
9th
10th
11th
Brazill
12th
13th
14th
15th
16th
17th
19th
21st
22nd


TS CABINET
EF CABINET
COMM CAN
U.G. COMM
O.H. COMM
GROUND
#X DROP #
NOT TO SCALE
MLK ST
Alley
J ST
I ST
YAKIMA
TACOMA
#1
N 1ST
#2
#3
#4
#5
DIVISION
MASTER
S 3rd St
S 5th St
6TH AV
#6
#7
#8
#9
ST HELENS
S 9TH
#10
#11
#12
S 10TH
#13
#14
#15
#16
#17
S 11TH

9th/Commerce

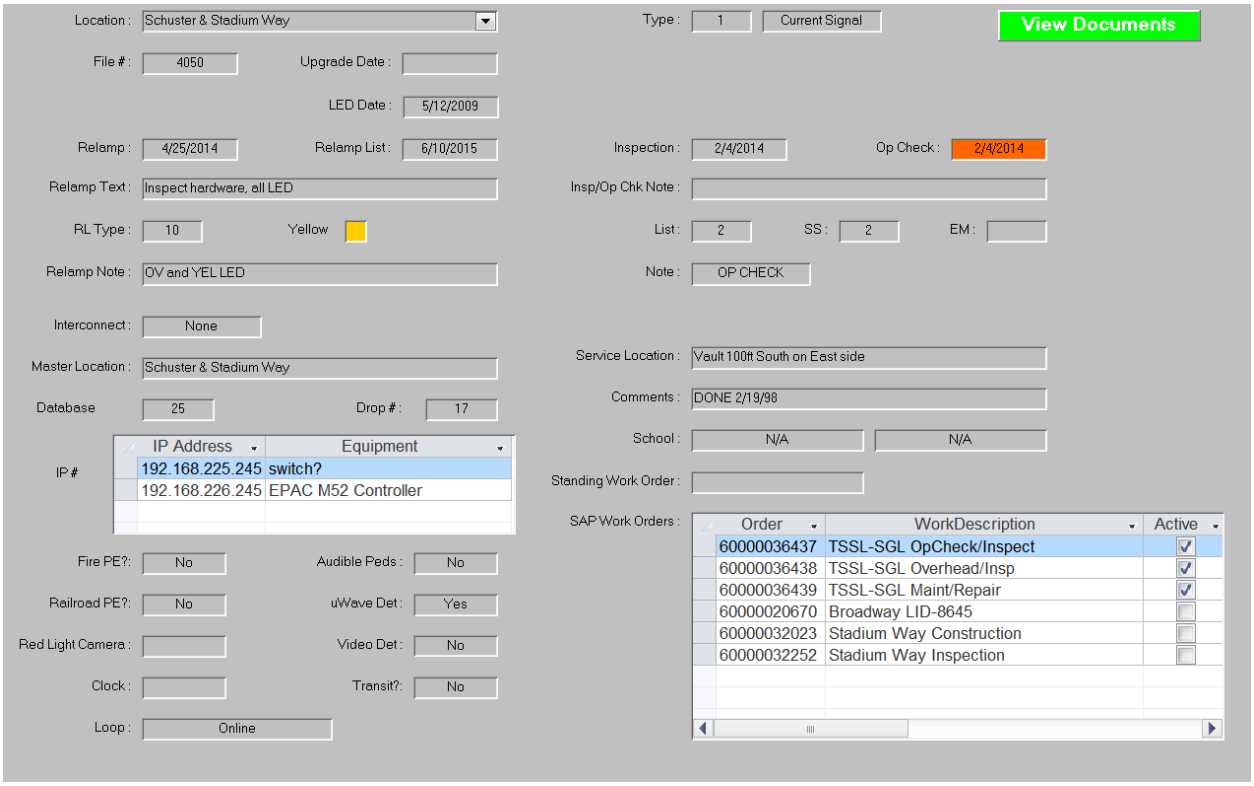


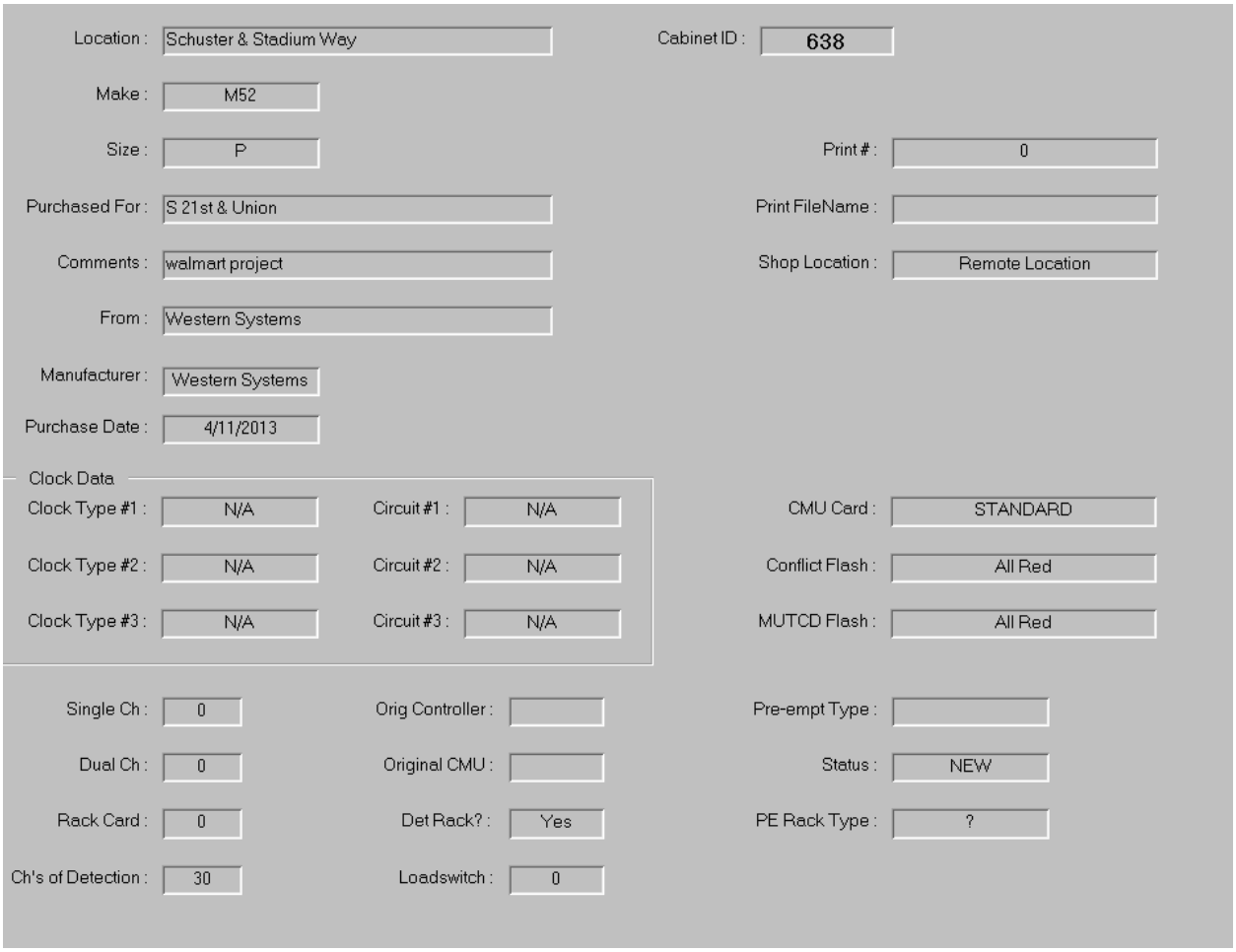

Location : S 9th & Commerce
Cabinet ID : 458
Make : LMD
Size : P
Print # : 26
Purchased For : S 9th & Commerce
Print FileName : jn13686.dwg
Comments :
Shop Location : Remote Location
From : S 9th & Commerce
Manufacturer : Northwest Signal
Purchase Date : 7/15/2002
Clock Data
Clock Type #1 : LMD 9200
Circuit #1 : N/A
CMU Card : SPECIAL
Clock Type #2 : LMD 9200
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : LMD 9200
Circuit #3 : Detector Relay
MUTCD Flash : All Red
Single Ch : 0
Orig Controller : 406
Pre-empt Type :
Dual Ch : 0
Original CMU : 418
Status : FIELD
Rack Card : 8
Det Rack? : Yes
PE Rack Type : NWS-LRT
Ch's of Detection : 30
Loadswitch : 10

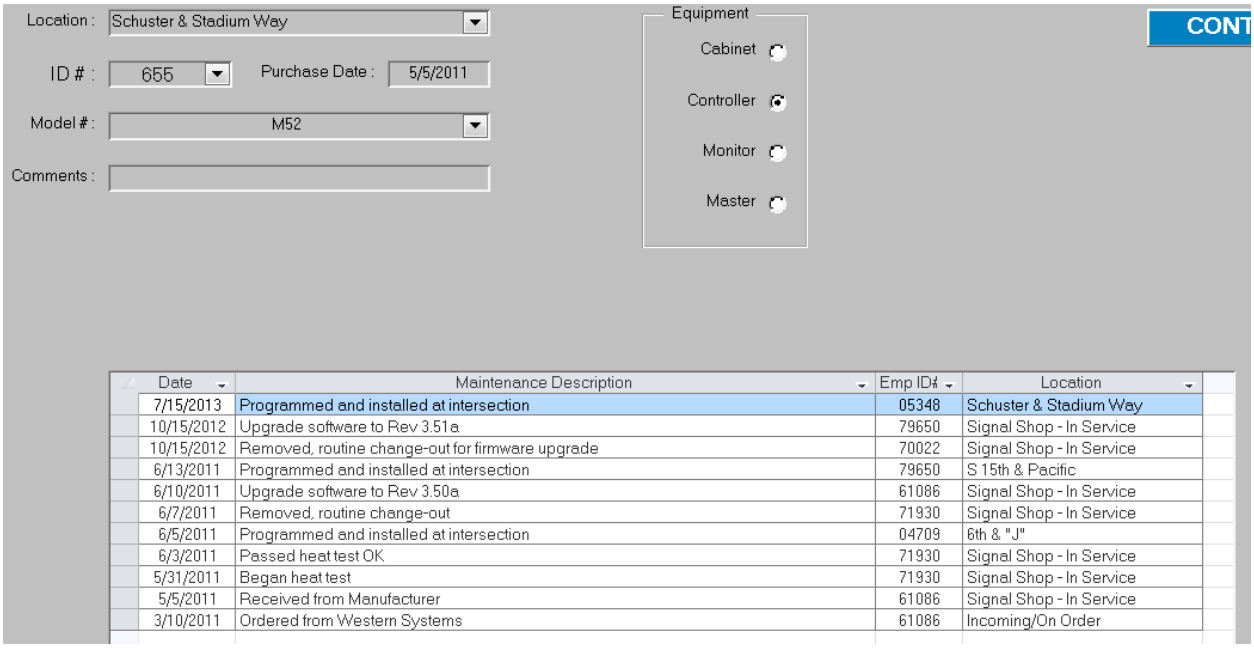


Date	Maintenance Description	Emp ID#	Location
12/8/2012	Programmed and installed at intersection	70022	S 9th & Commerce
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
10/15/2012	Removed, routine change-out for firmware upgrade	70022	Signal Shop - In Service
6/13/2011	Programmed and installed at intersection	71930	S 76th & Pacific
6/8/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/7/2011	Removed, routine change-out	71930	Signal Shop - In Service
4/10/2011	Programmed and installed at intersection	15957	S 9th & "A"
3/31/2011	Passed heat test OK	61086	Signal Shop - In Service
3/28/2011	Began heat test	71930	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

Stadium Way/I-705 Ramps (“Schuster & Stadium Way”)

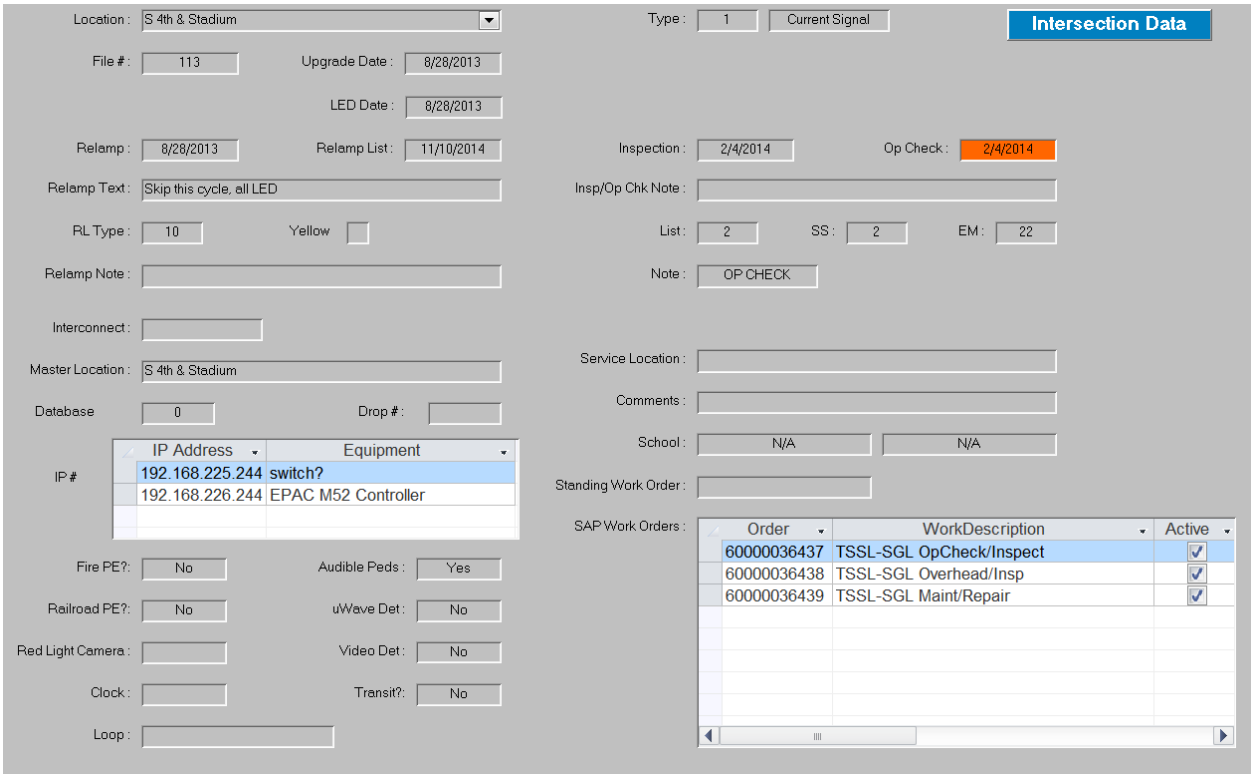


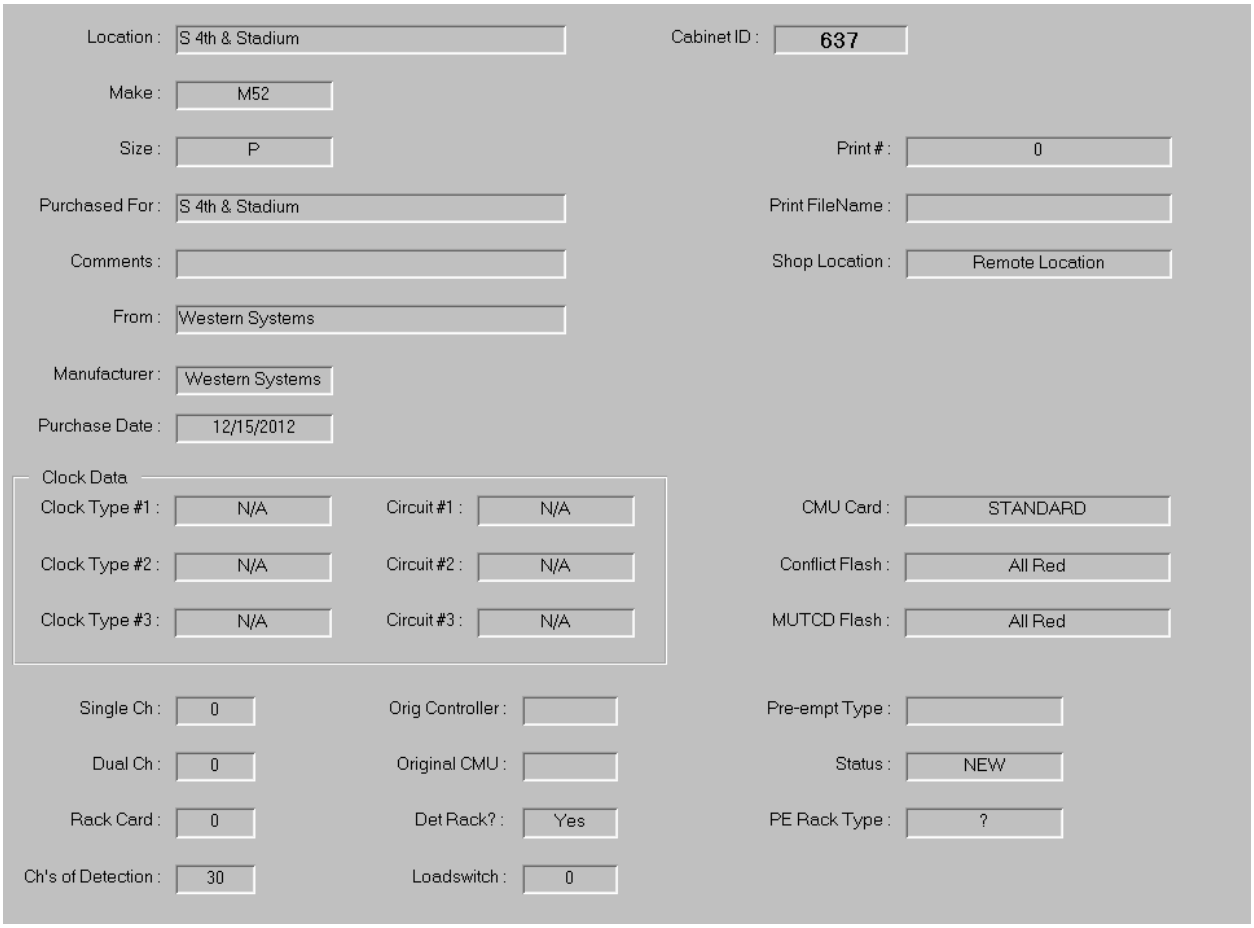

Location : Schuster & Stadium Way
Cabinet ID : 638
Make : M52
Size : P
Print # : 0
Purchased For : S 21st & Union
Print FileName :
Comments : walmart project
Shop Location : Remote Location
From : Western Systems
Manufacturer : Western Systems
Purchase Date : 4/11/2013
Clock Data
Clock Type #1 : N/A
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : N/A
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : N/A
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : NEW
Rack Card : 0
Det Rack? : Yes
PE Rack Type : ?
Ch's of Detection : 30
Loadswitch : 0

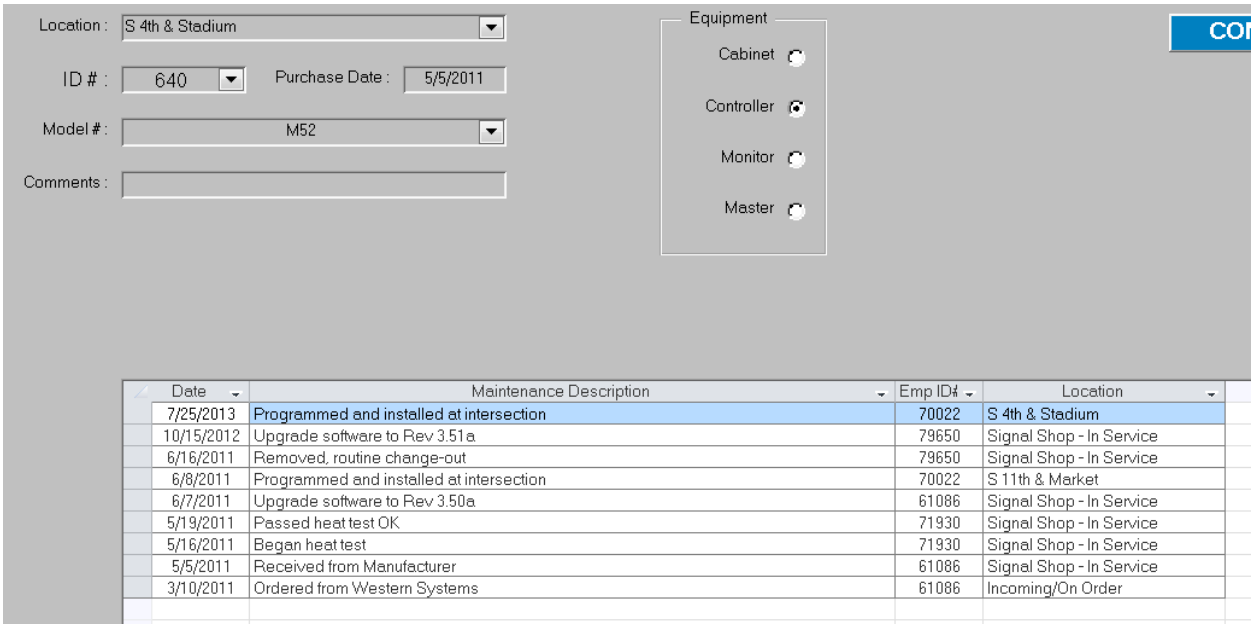


Date	Maintenance Description	Emp ID#	Location
7/15/2013	Programmed and installed at intersection	05348	Schuster & Stadium Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
10/15/2012	Removed, routine change-out for firmware upgrade	70022	Signal Shop - In Service
6/13/2011	Programmed and installed at intersection	79650	S 15th & Pacific
6/10/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/7/2011	Removed, routine change-out	71930	Signal Shop - In Service
6/5/2011	Programmed and installed at intersection	04709	6th & "J"
6/3/2011	Passed heat test OK	71930	Signal Shop - In Service
5/31/2011	Began heat test	71930	Signal Shop - In Service
5/5/2011	Received from Manufacturer	61086	Signal Shop - In Service
3/10/2011	Ordered from Western Systems	61086	Incoming/On Order

Stadium Way/South 4th Street

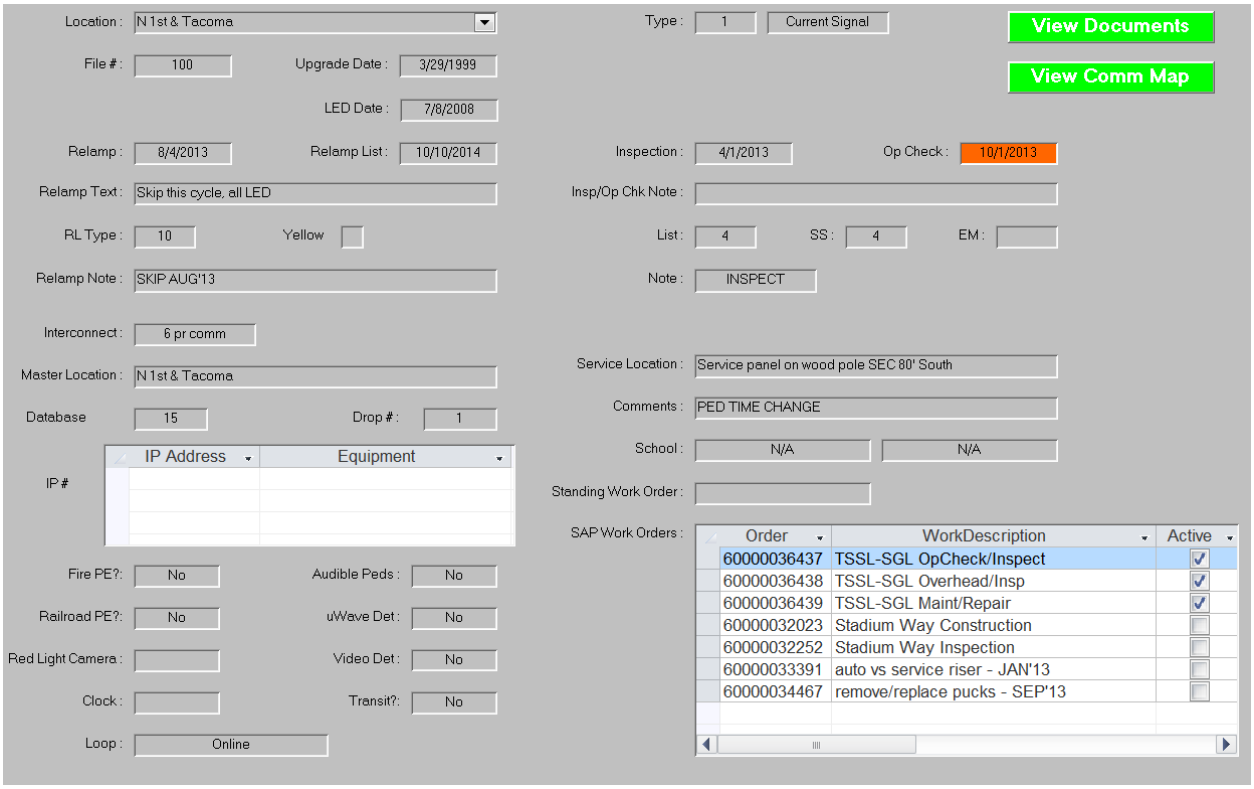



Location : S 4th & Stadium
Cabinet ID : 637
Make : M52
Size : P
Print # : 0
Purchased For : S 4th & Stadium
Print FileName :
Comments :
Shop Location : Remote Location
From : Western Systems
Manufacturer : Western Systems
Purchase Date : 12/15/2012
Clock Data
Clock Type #1 : N/A
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : N/A
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : N/A
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : NEW
Rack Card : 0
Det Rack? : Yes
PE Rack Type : ?
Ch's of Detection : 30
Loadswitch : 0

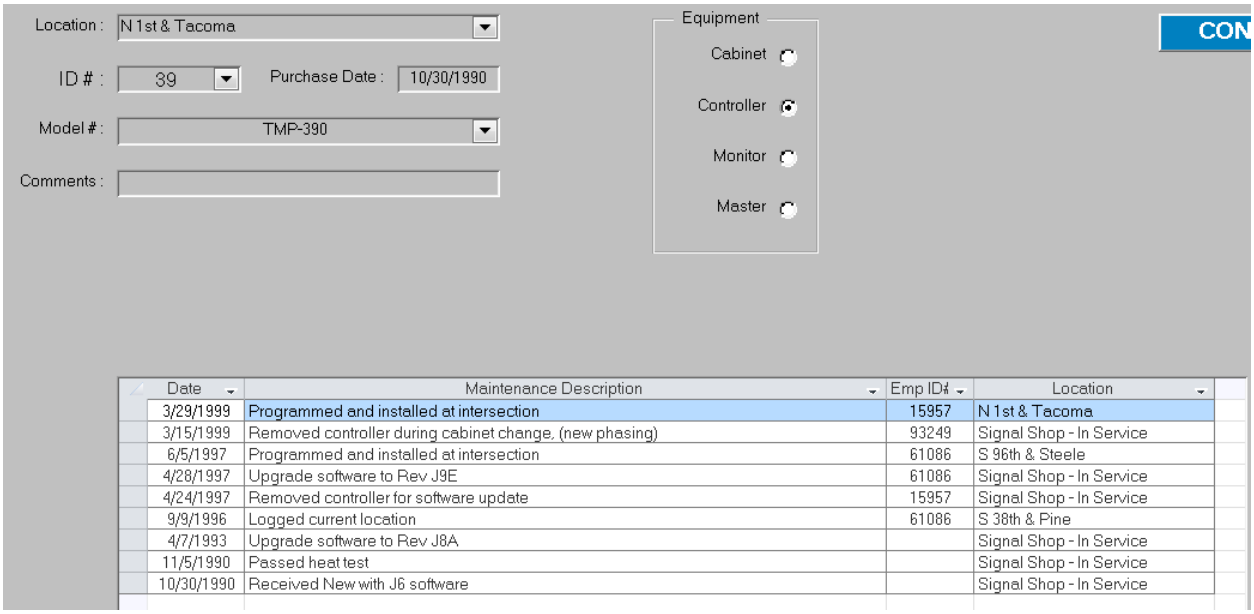


Date	Maintenance Description	Emp ID#	Location
7/25/2013	Programmed and installed at intersection	70022	S 4th & Stadium
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
6/16/2011	Removed, routine change-out	79650	Signal Shop - In Service
6/8/2011	Programmed and installed at intersection	70022	S 11th & Market
6/7/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
5/19/2011	Passed heat test OK	71930	Signal Shop - In Service
5/16/2011	Began heat test	71930	Signal Shop - In Service
5/5/2011	Received from Manufacturer	61086	Signal Shop - In Service
3/10/2011	Ordered from Western Systems	61086	Incoming/On Order

North 1st St/N Tacoma Ave

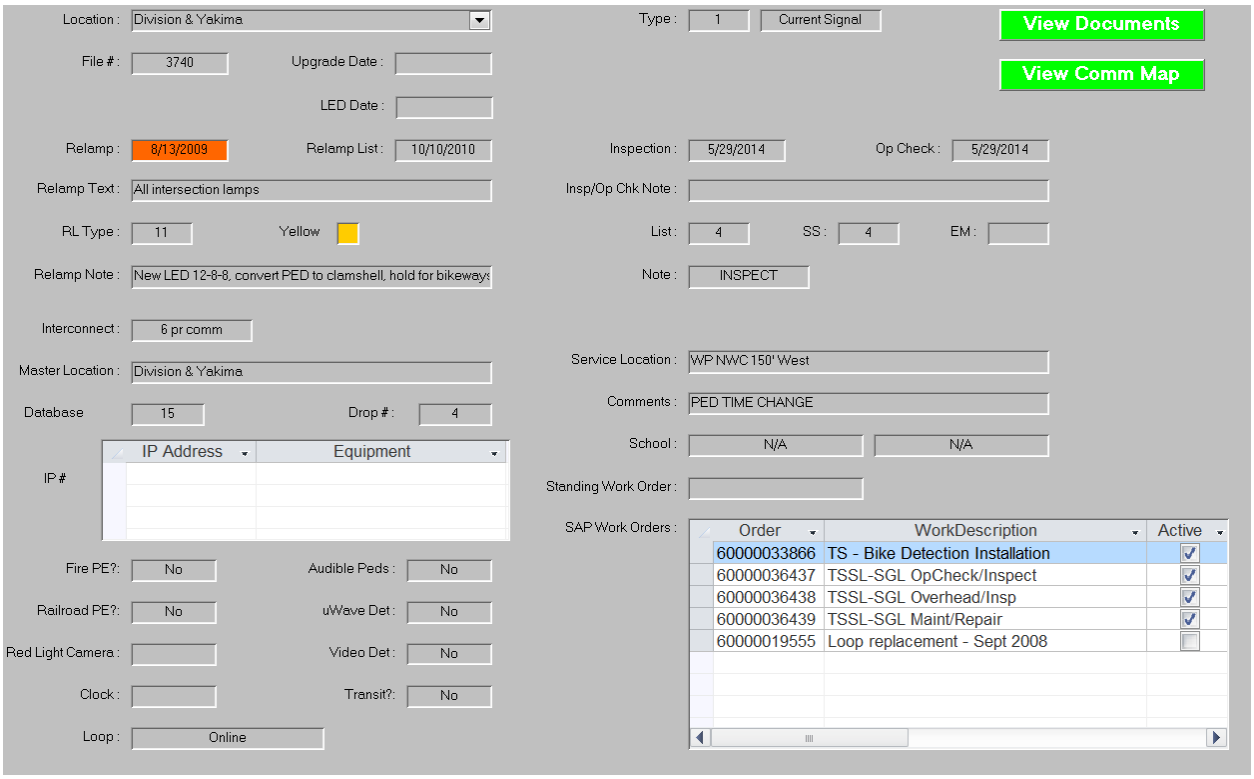


Location : N 1st & Tacoma
Cabinet ID : 377
Make : 390
Size : M
Print # :
Purchased For : N 1st & Tacoma
Print FileName :
Comments :
Shop Location : Remote Location
From : N 1st & Tacoma
Manufacturer : IDC
Purchase Date : 7/14/1999
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : Flash
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : Detector Relay
MUTCD Flash : Yellow on S 11th
Single Ch : 0
Orig Controller : 306
Pre-empt Type :
Dual Ch : 0
Original CMU : 343
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : None
Ch's of Detection : 20
Loadswitch : 4

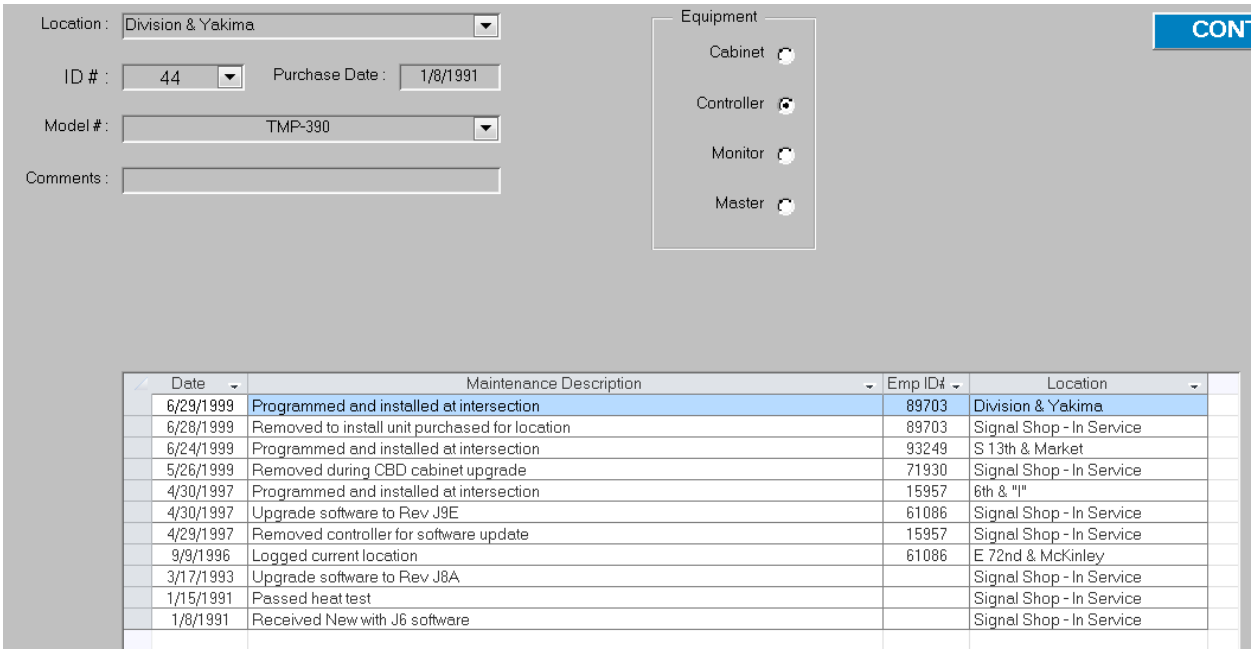


Date	Maintenance Description	Emp ID#	Location
3/29/1999	Programmed and installed at intersection	15957	N 1st & Tacoma
3/15/1999	Removed controller during cabinet change. (new phasing)	93249	Signal Shop - In Service
6/5/1997	Programmed and installed at intersection	61086	S 96th & Steele
4/28/1997	Upgrade software to Rev J9E	61086	Signal Shop - In Service
4/24/1997	Removed controller for software update	15957	Signal Shop - In Service
9/9/1996	Logged current location	61086	S 38th & Pine
4/7/1993	Upgrade software to Rev J8A		Signal Shop - In Service
11/5/1990	Passed heat test		Signal Shop - In Service
10/30/1990	Received New with J6 software		Signal Shop - In Service

N. 1st Street/Division ("Division & Yakima") – some of these details may have changed recently based on a City bikeways project that now crosses through this intersection

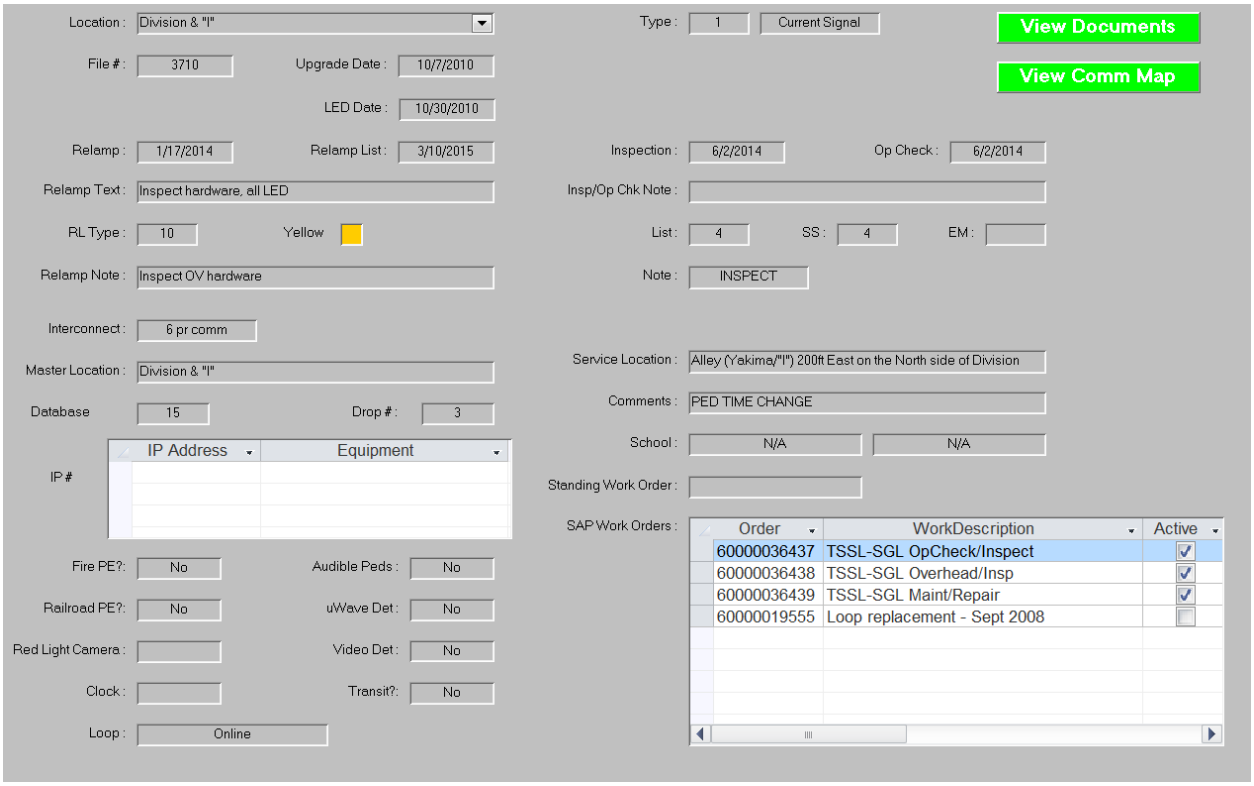


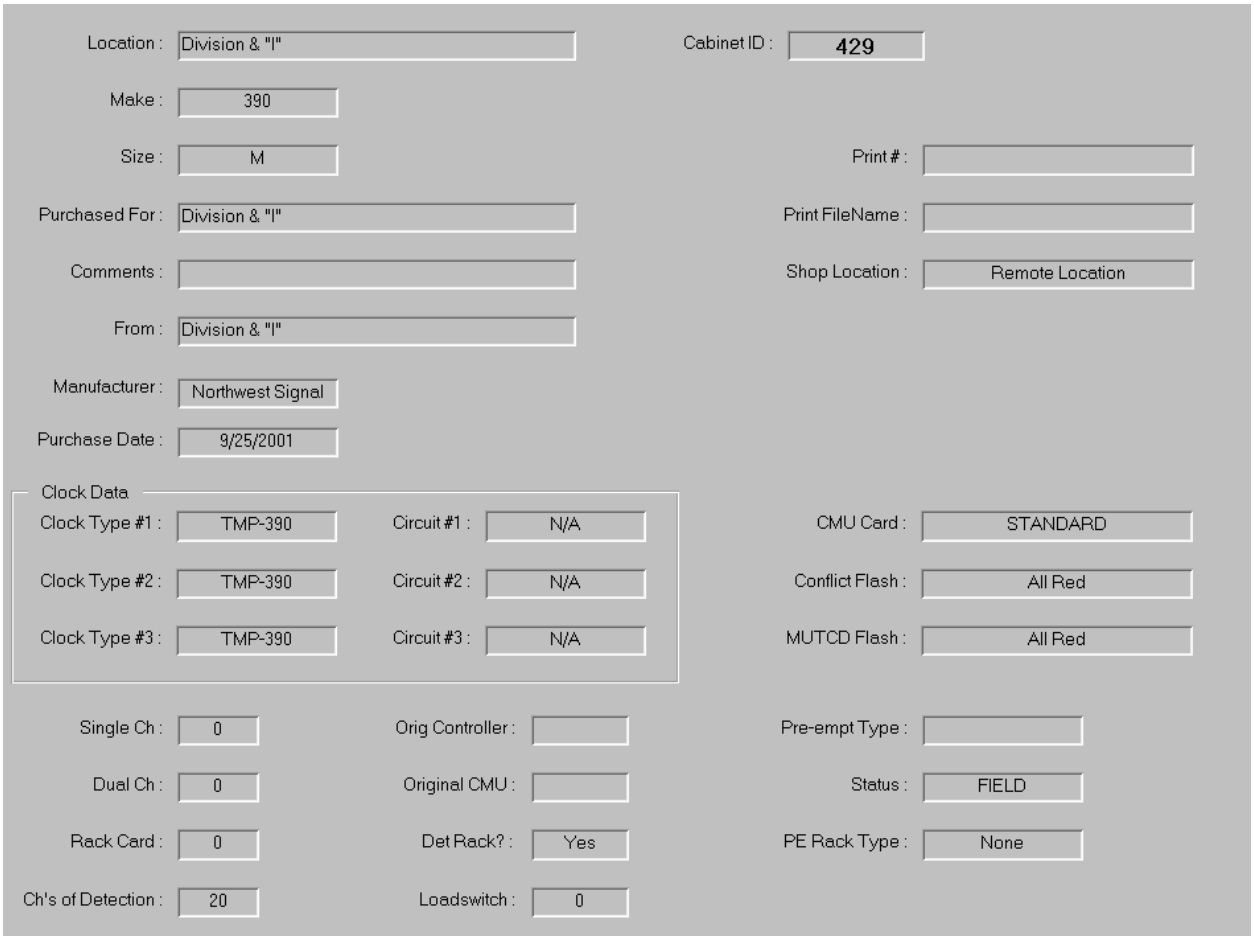
Location : Division & Yakima
Cabinet ID : 234
Make : 390
Size : P
Print # :
Purchased For : Division & Yakima
Print FileName :
Comments :
Shop Location : Remote Location
From : Division & Yakima
Manufacturer : Safety Signal
Purchase Date : 1/1/1989
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : Detector Relay
MUTCD Flash : None
Single Ch : 5
Orig Controller :
Pre-empt Type : TMP-390
Dual Ch : 0
Original CMU :
Status : FIELD
Rack Card : 0
Det Rack? : No
PE Rack Type : None
Ch's of Detection : 8
Loadswitch : 6

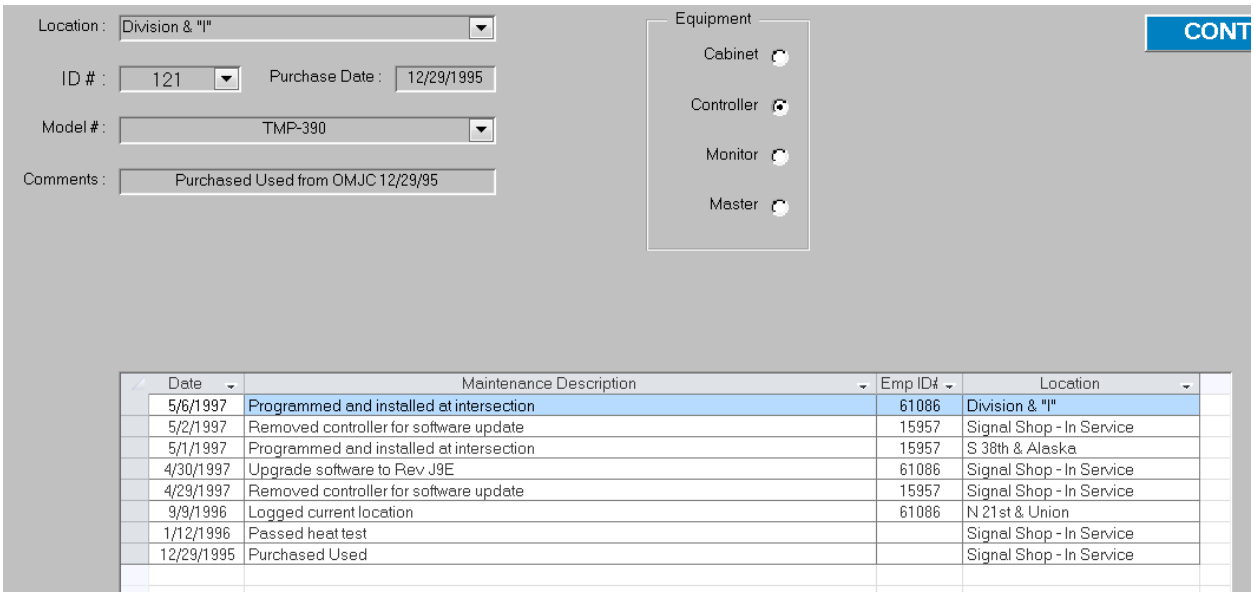


Date	Maintenance Description	Emp ID#	Location
6/29/1999	Programmed and installed at intersection	89703	Division & Yakima
6/28/1999	Removed to install unit purchased for location	89703	Signal Shop - In Service
6/24/1999	Programmed and installed at intersection	93249	S 13th & Market
5/26/1999	Removed during CBD cabinet upgrade	71930	Signal Shop - In Service
4/30/1997	Programmed and installed at intersection	15957	6th & "I"
4/30/1997	Upgrade software to Rev J9E	61086	Signal Shop - In Service
4/29/1997	Removed controller for software update	15957	Signal Shop - In Service
9/9/1996	Logged current location	61086	E 72nd & McKinley
3/17/1993	Upgrade software to Rev J8A		Signal Shop - In Service
1/15/1991	Passed heat test		Signal Shop - In Service
1/8/1991	Received New with J6 software		Signal Shop - In Service

Division Ave/I Street

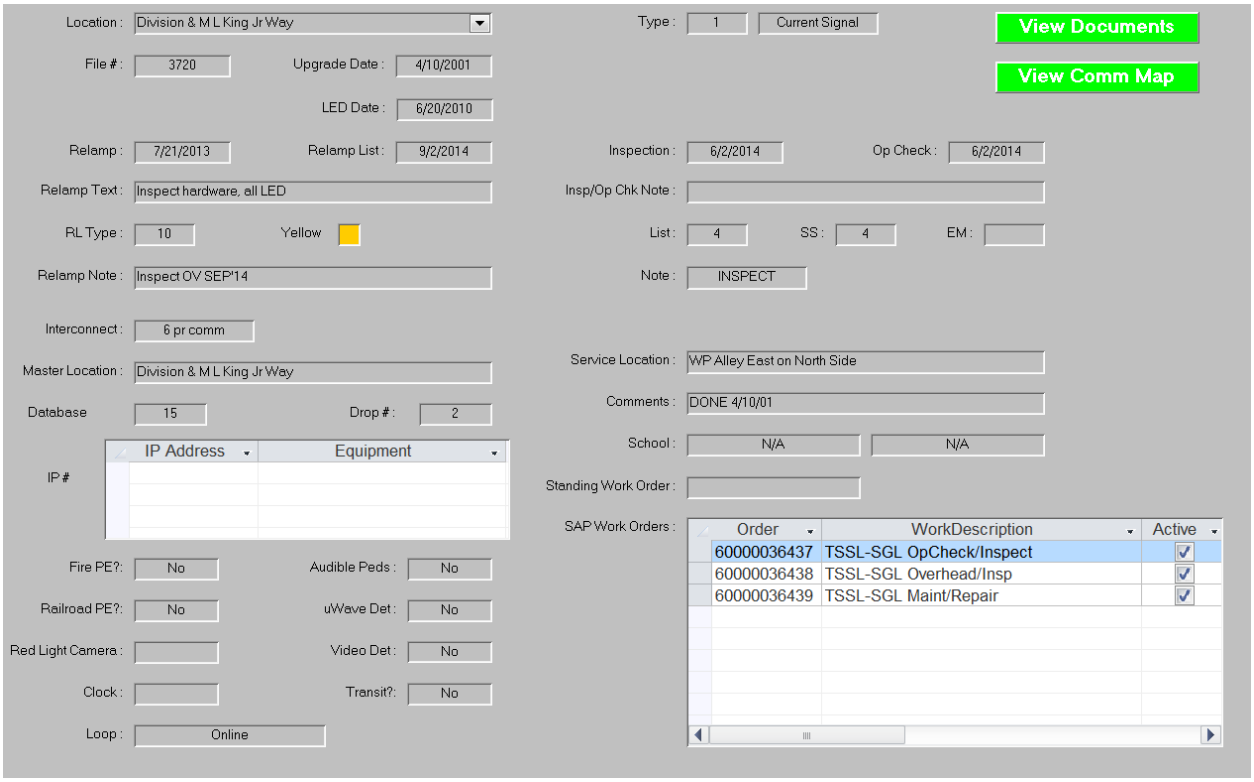



Location : Division & "I"
Cabinet ID : 429
Make : 390
Size : M
Print # :
Purchased For : Division & "I"
Print FileName :
Comments :
Shop Location : Remote Location
From : Division & "I"
Manufacturer : Northwest Signal
Purchase Date : 9/25/2001
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : None
Ch's of Detection : 20
Loadswitch : 0

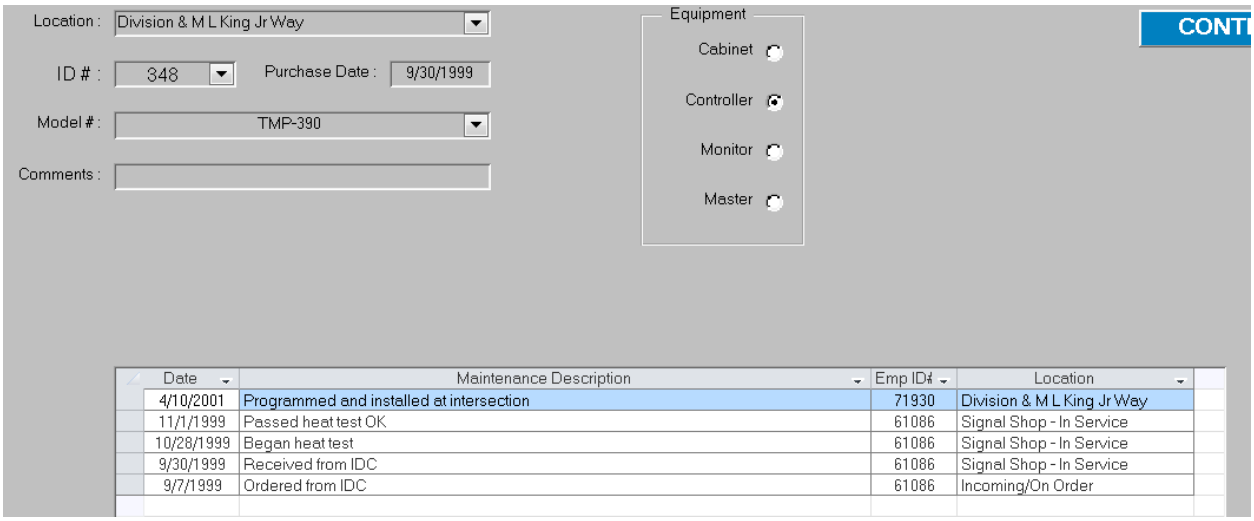


Date	Maintenance Description	Emp ID#	Location
5/6/1997	Programmed and installed at intersection	61086	Division & "I"
5/2/1997	Removed controller for software update	15957	Signal Shop - In Service
5/1/1997	Programmed and installed at intersection	15957	S 38th & Alaska
4/30/1997	Upgrade software to Rev J9E	61086	Signal Shop - In Service
4/29/1997	Removed controller for software update	15957	Signal Shop - In Service
9/9/1996	Logged current location	61086	N 21st & Union
1/12/1996	Passed heat test		Signal Shop - In Service
12/29/1995	Purchased Used		Signal Shop - In Service

Division Ave/MLK

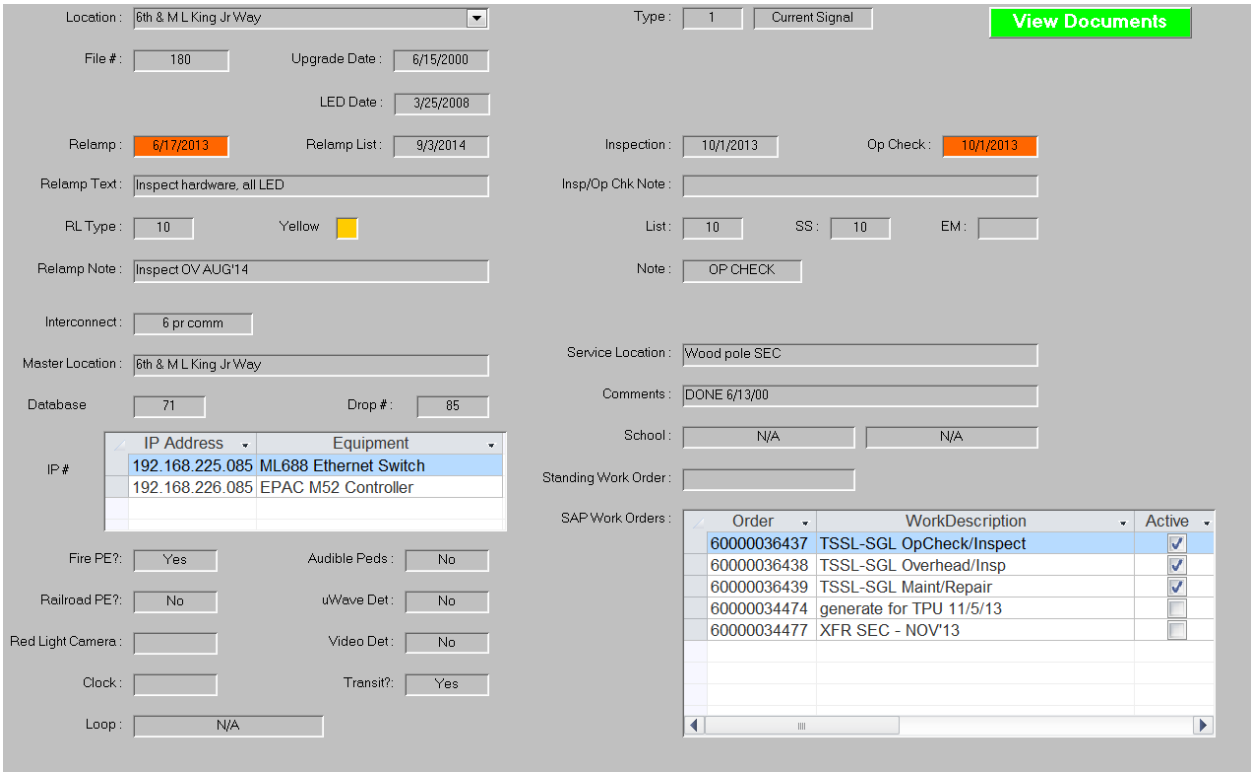


Location : Division & M L King Jr Way
Cabinet ID : 417
Make : 390
Size : M
Print # :
Purchased For : Division & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : Division & M L King Jr Way
Manufacturer : IDC
Purchase Date : 12/22/1999
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller : 348
Pre-empt Type :
Dual Ch : 0
Original CMU : 377
Status : FIELD
Rack Card : 9
Det Rack? : Yes
PE Rack Type : None
Ch's of Detection : 20
Loadswitch : 6

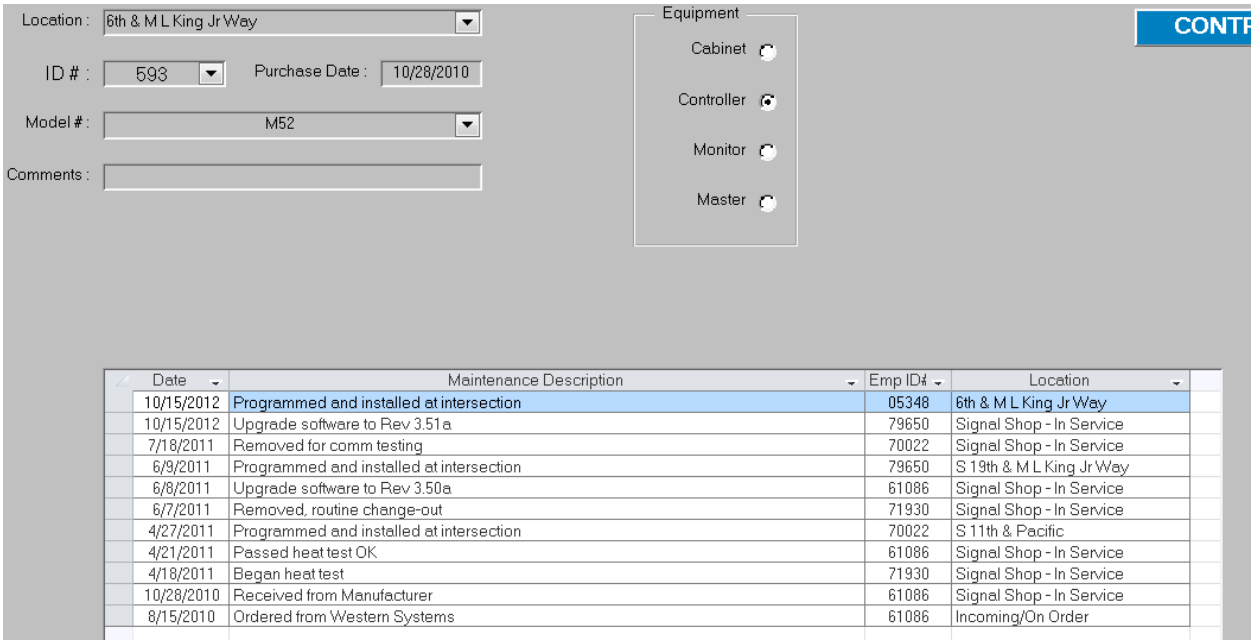


Date	Maintenance Description	Emp ID#	Location
4/10/2001	Programmed and installed at intersection	71930	Division & M L King Jr Way
11/1/1999	Passed heat test OK	61086	Signal Shop - In Service
10/28/1999	Began heat test	61086	Signal Shop - In Service
9/30/1999	Received from IDC	61086	Signal Shop - In Service
9/7/1999	Ordered from IDC	61086	Incoming/On Order

MLK/6th Ave

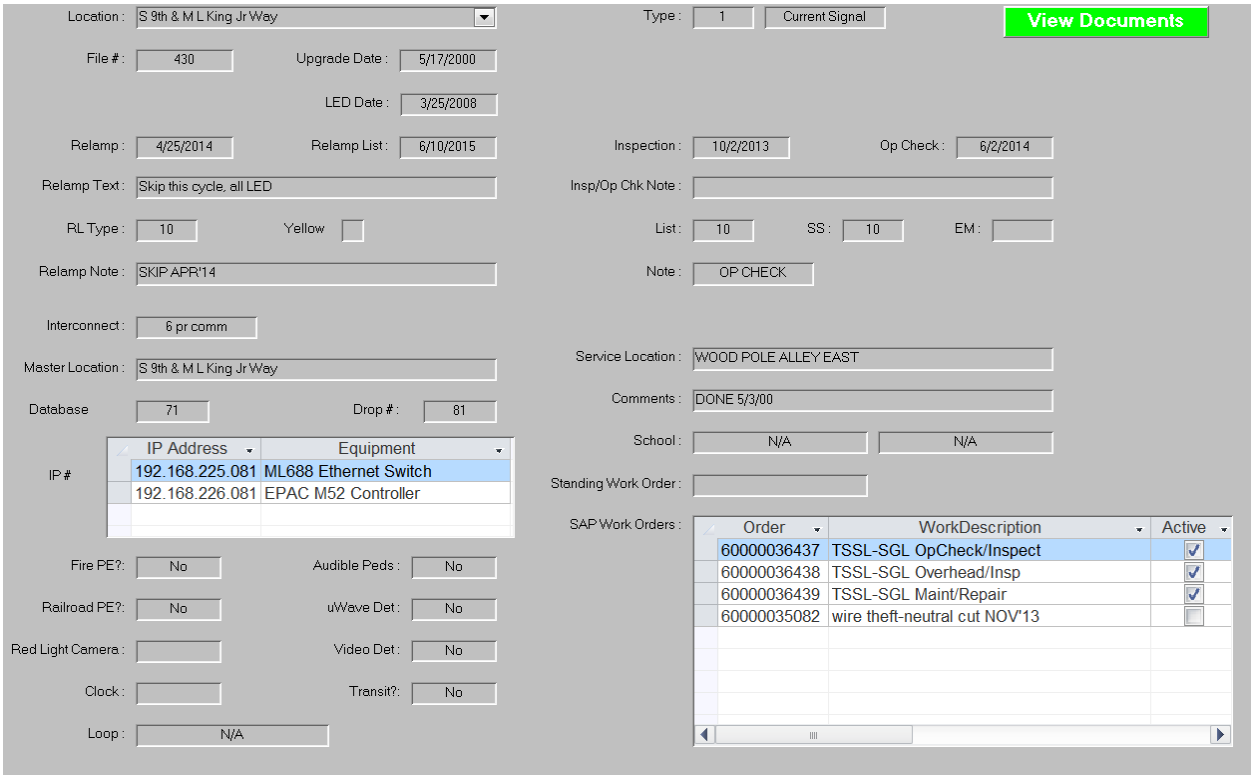

Location : 6th & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 180
Upgrade Date : 6/15/2000
LED Date : 3/25/2008
Relamp : 6/17/2013
Relamp List : 9/3/2014
Inspection : 10/1/2013
Op Check : 10/1/2013
Relamp Text : Inspect hardware, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : Inspect OV AUG'14
Note : OP CHECK
Interconnect : 6 pr comm
Master Location : 6th & M L King Jr Way
Service Location : Wood pole SEC
Database 71
Drop # : 85
Comments : DONE 6/13/00
School : N/A N/A
IP #
IP Address Equipment
192.168.225.085 ML688 Ethernet Switch
192.168.226.085 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
60000034474 generate for TPU 11/5/13
60000034477 XFR SEC - NOV'13
Fire PE?: Yes
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: Yes
Loop : N/A

Location : 6th & M L King Jr Way
Cabinet ID : 556
Make : 390
Size : P
Print # : 0
Purchased For : 6th & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : 6th & M L King Jr Way
Manufacturer : McCain
Purchase Date : 12/22/2005
Clock Data
Clock Type #1 : N/A
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : N/A
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : N/A
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : MC-4
Ch's of Detection : 30
Loadswitch : 0

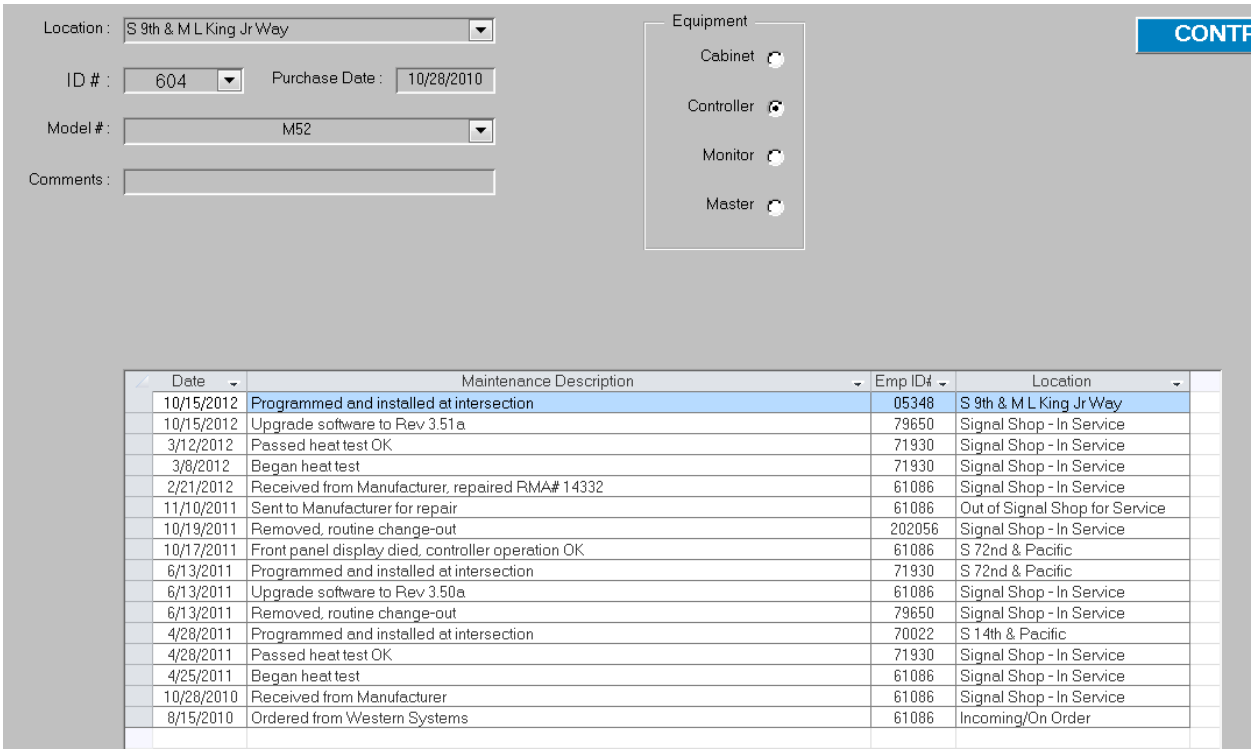


Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	6th & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
7/18/2011	Removed for comm testing	70022	Signal Shop - In Service
6/9/2011	Programmed and installed at intersection	79650	S 19th & M L King Jr Way
6/8/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/7/2011	Removed, routine change-out	71930	Signal Shop - In Service
4/27/2011	Programmed and installed at intersection	70022	S 11th & Pacific
4/21/2011	Passed heat test OK	61086	Signal Shop - In Service
4/18/2011	Began heat test	71930	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

MLK/S 9th

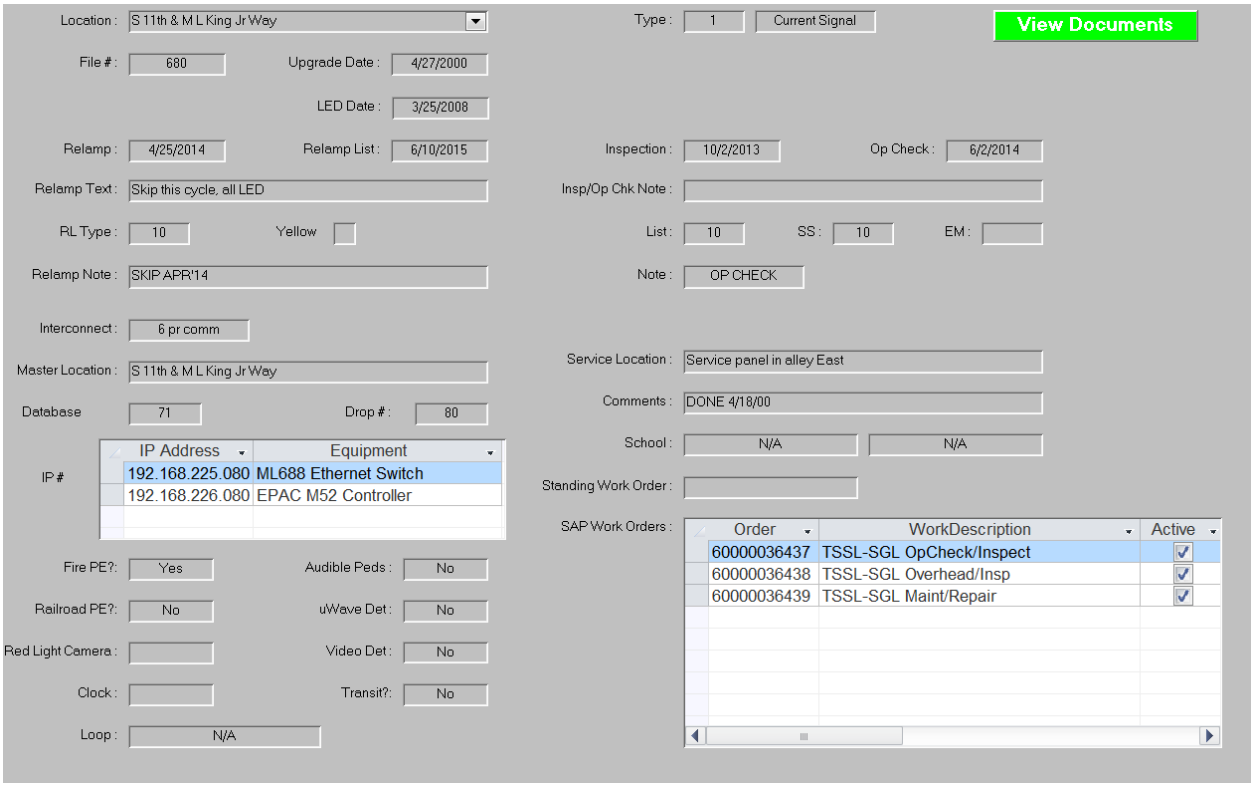

Location : S 9th & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 430
Upgrade Date : 5/17/2000
LED Date : 3/25/2008
Relamp : 4/25/2014
Relamp List : 6/10/2015
Inspection : 10/2/2013
Op Check : 6/2/2014
Relamp Text : Skip this cycle, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : SKIP APR'14
Note : OP CHECK
Interconnect : 6 pr comm
Master Location : S 9th & M L King Jr Way
Service Location : WOOD POLE ALLEY EAST
Database 71
Drop # : 81
Comments : DONE 5/3/00
School : N/A N/A
IP #
IP Address Equipment
192.168.225.081 ML688 Ethernet Switch
192.168.226.081 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
60000035082 wire theft-neutral cut NOV'13
Fire PE?: No
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: No
Loop : N/A

Location : S 9th & M L King Jr Way
Cabinet ID : 375
Make : 390
Size : P
Print # :
Purchased For : S 9th & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : S 9th & M L King Jr Way
Manufacturer : IDC
Purchase Date : 10/27/1999
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : Detector Relay
MUTCD Flash : All Red
Single Ch : 0
Orig Controller : 304
Pre-empt Type :
Dual Ch : 0
Original CMU : 353
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : None
Ch's of Detection : 30
Loadswitch : 0

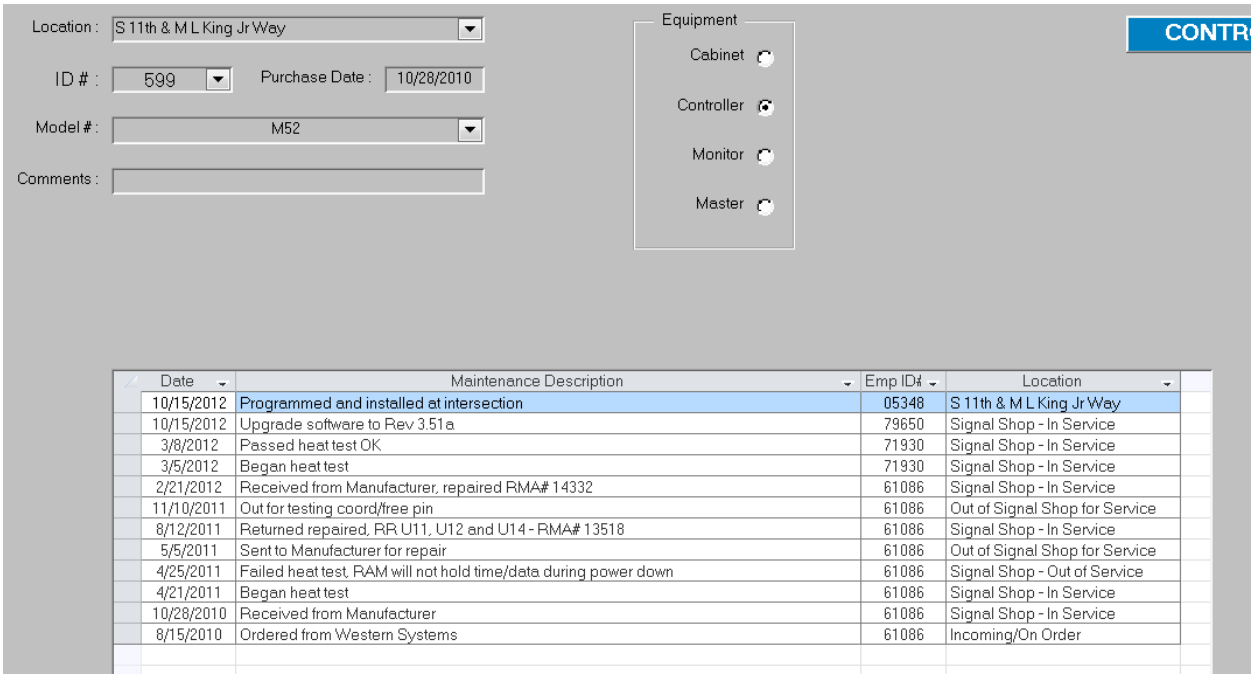


Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	S 9th & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
3/12/2012	Passed heat test OK	71930	Signal Shop - In Service
3/8/2012	Began heat test	71930	Signal Shop - In Service
2/21/2012	Received from Manufacturer, repaired RMA# 14332	61086	Signal Shop - In Service
11/10/2011	Sent to Manufacturer for repair	61086	Out of Signal Shop for Service
10/19/2011	Removed, routine change-out	202056	Signal Shop - In Service
10/17/2011	Front panel display died, controller operation OK	61086	S 72nd & Pacific
6/13/2011	Programmed and installed at intersection	71930	S 72nd & Pacific
6/13/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/13/2011	Removed, routine change-out	79650	Signal Shop - In Service
4/28/2011	Programmed and installed at intersection	70022	S 14th & Pacific
4/28/2011	Passed heat test OK	71930	Signal Shop - In Service
4/25/2011	Began heat test	61086	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

MLK/11th

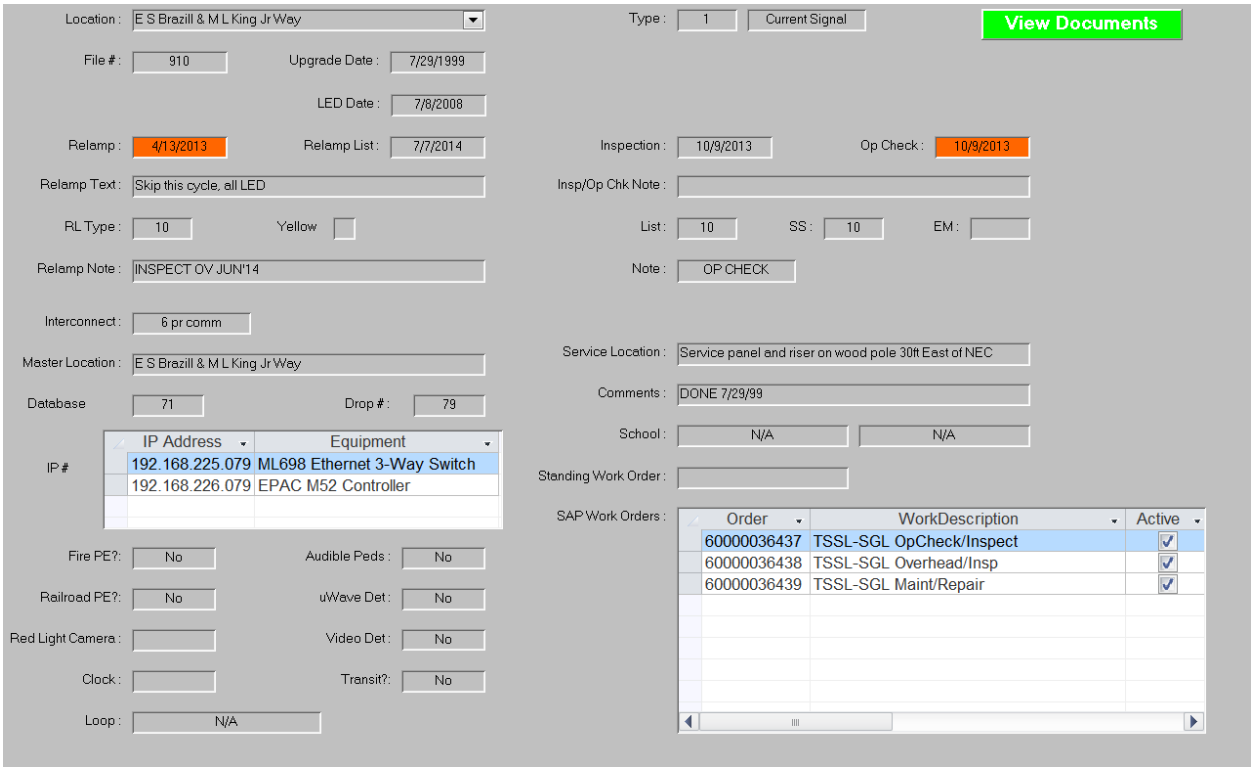

Location : S 11th & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 680
Upgrade Date : 4/27/2000
LED Date : 3/25/2008
Relamp : 4/25/2014
Relamp List : 6/10/2015
Inspection : 10/2/2013
Op Check : 6/2/2014
Relamp Text : Skip this cycle, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : SKIP APR'14
Note : OP CHECK
Interconnect : 6 pr comm
Master Location : S 11th & M L King Jr Way
Service Location : Service panel in alley East
Database 71
Drop # : 80
Comments : DONE 4/18/00
School : N/A N/A
IP #
IP Address Equipment
192.168.225.080 ML688 Ethernet Switch
192.168.226.080 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
Fire PE?: Yes
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: No
Loop : N/A

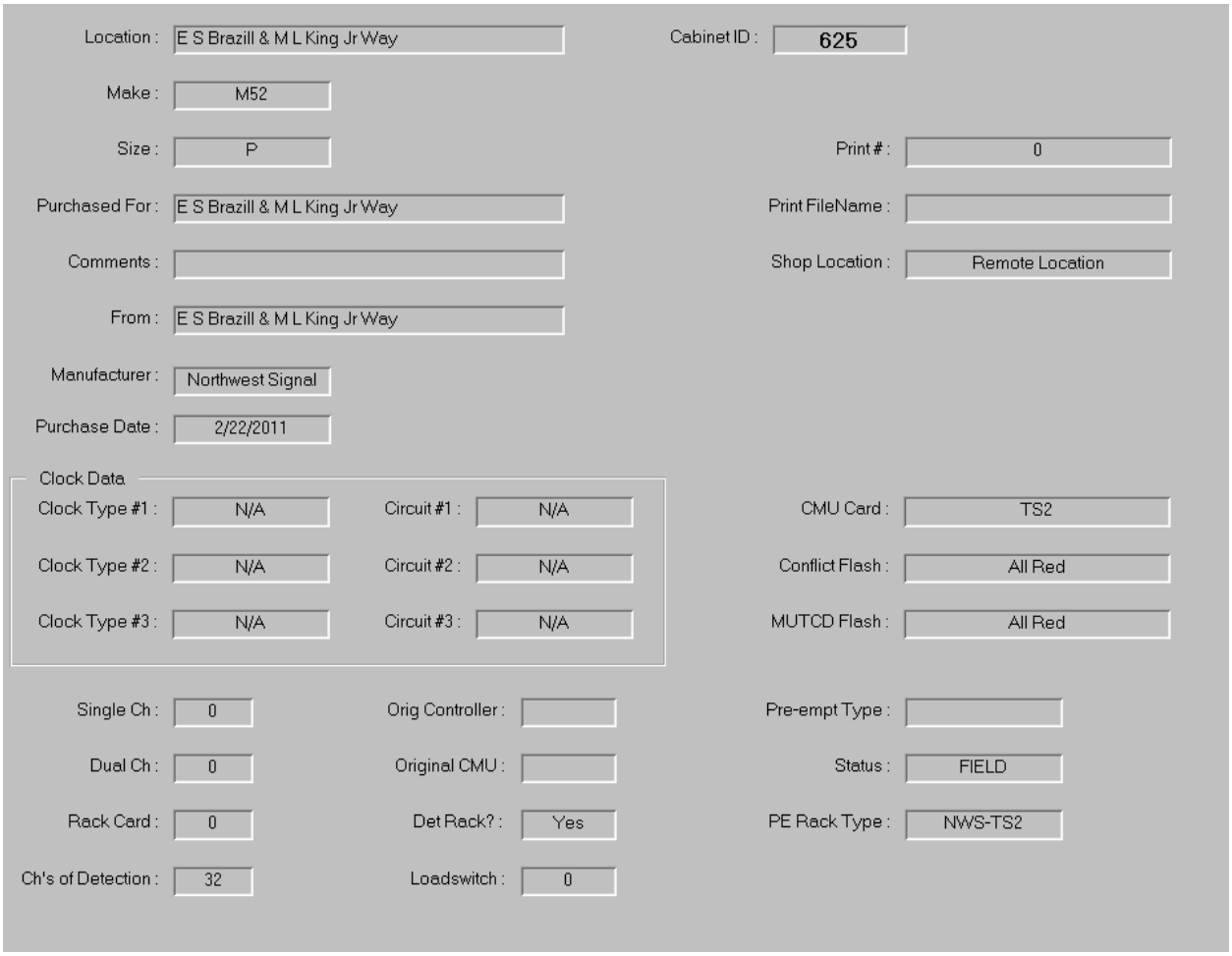
Location : S 11th & M L King Jr Way
Cabinet ID : 630
Make : M52
Size : P
Print # : 0
Purchased For : S 11th & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : S 11th & M L King Jr Way
Manufacturer : Northwest Signal
Purchase Date : 3/1/2011
Clock Data
Clock Type #1 : N/A
Circuit #1 : N/A
CMU Card : TS2
Clock Type #2 : N/A
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : N/A
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : NWS-TS2
Ch's of Detection : 32
Loadswitch : 0

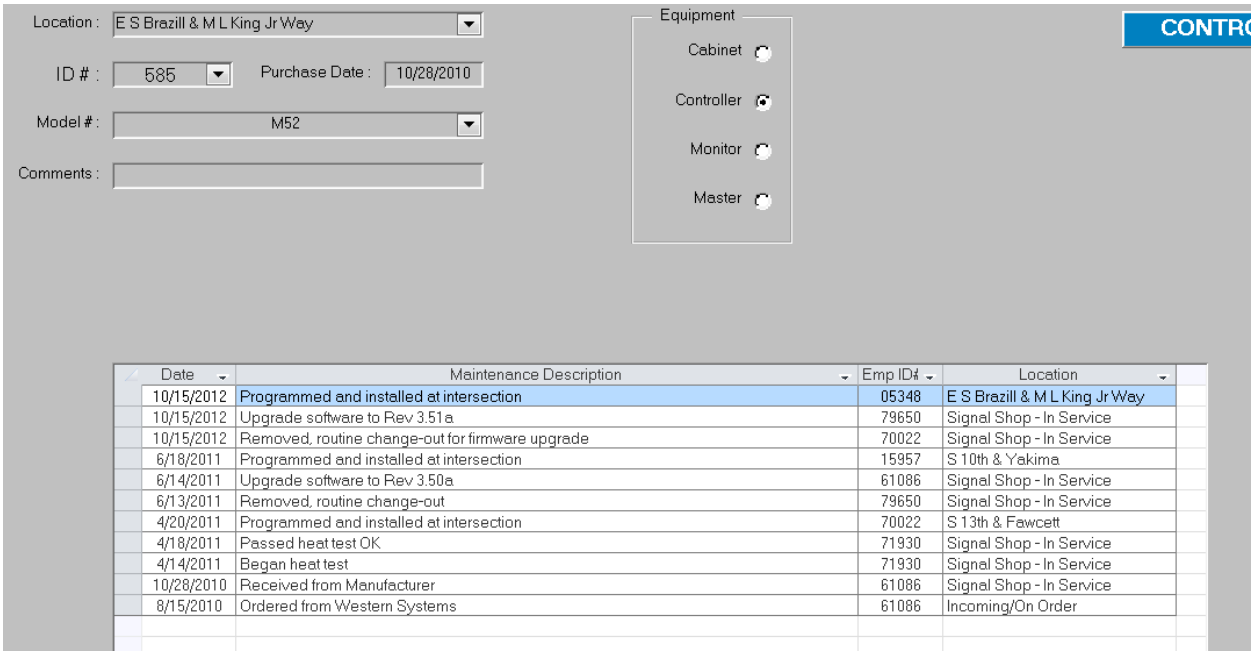


Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	S 11th & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
3/8/2012	Passed heat test OK	71930	Signal Shop - In Service
3/5/2012	Began heat test	71930	Signal Shop - In Service
2/21/2012	Received from Manufacturer, repaired RMA# 14332	61086	Signal Shop - In Service
11/10/2011	Out for testing coord/free pin	61086	Out of Signal Shop for Service
8/12/2011	Returned repaired, RR U11, U12 and U14 - RMA# 13518	61086	Signal Shop - In Service
5/5/2011	Sent to Manufacturer for repair	61086	Out of Signal Shop for Service
4/25/2011	Failed heat test, RAM will not hold time/data during power down	61086	Signal Shop - Out of Service
4/21/2011	Began heat test	61086	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

MLK/Earnest S Brazill

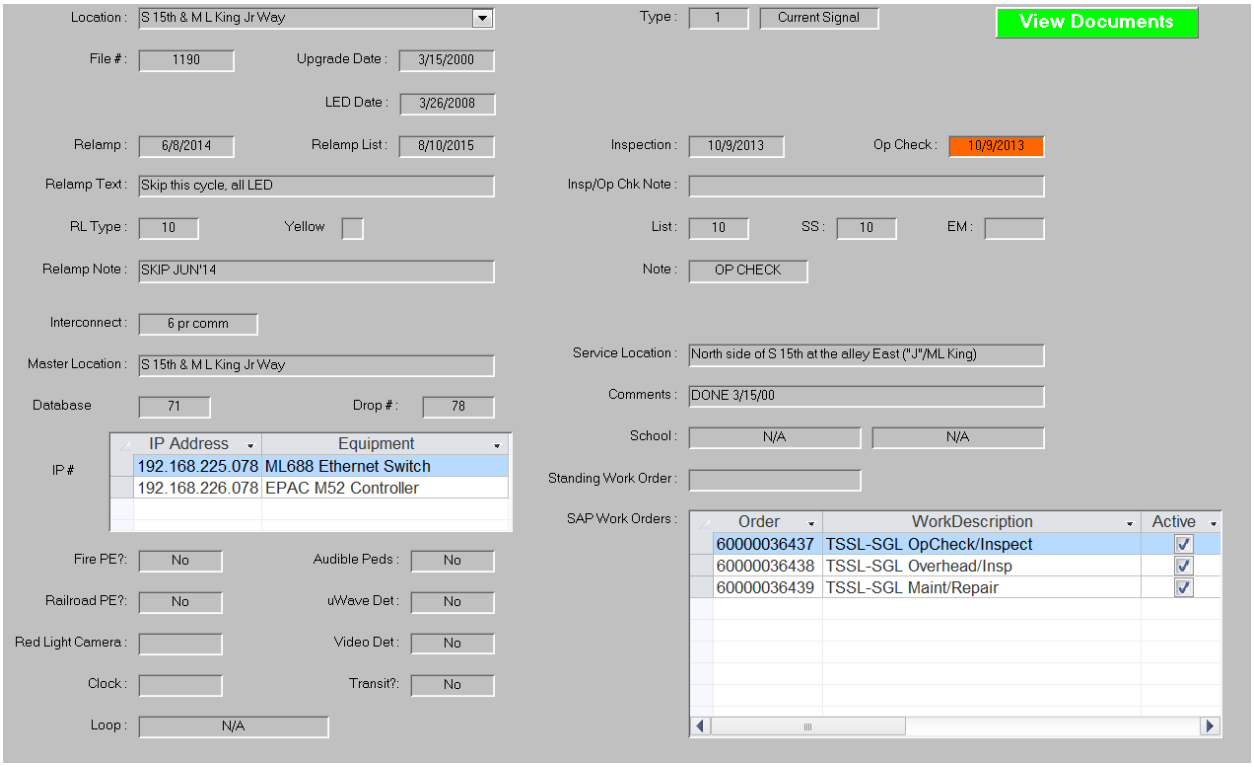

Location : E S Brazill & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 910
Upgrade Date : 7/29/1999
LED Date : 7/8/2008
Relamp : 4/13/2013
Relamp List : 7/7/2014
Inspection : 10/9/2013
Op Check : 10/9/2013
Relamp Text : Skip this cycle, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : INSPECT OV JUN'14
Note : OP CHECK
Interconnect : 6 pr comm
Master Location : E S Brazill & M L King Jr Way
Service Location : Service panel and riser on wood pole 30ft East of NEC
Database 71
Drop # : 79
Comments : DONE 7/29/99
School : N/A N/A
IP #
IP Address Equipment
192.168.225.079 ML698 Ethernet 3-Way Switch
192.168.226.079 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
Fire PE?: No
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: No
Loop : N/A


Location : E S Brazill & M L King Jr Way
Cabinet ID : 625
Make : M52
Size : P
Print # : 0
Purchased For : E S Brazill & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : E S Brazill & M L King Jr Way
Manufacturer : Northwest Signal
Purchase Date : 2/22/2011
Clock Data
Clock Type #1 : N/A
Circuit #1 : N/A
CMU Card : TS2
Clock Type #2 : N/A
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : N/A
Circuit #3 : N/A
MUTCD Flash : All Red
Single Ch : 0
Orig Controller :
Pre-empt Type :
Dual Ch : 0
Original CMU :
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : NWS-TS2
Ch's of Detection : 32
Loadswitch : 0

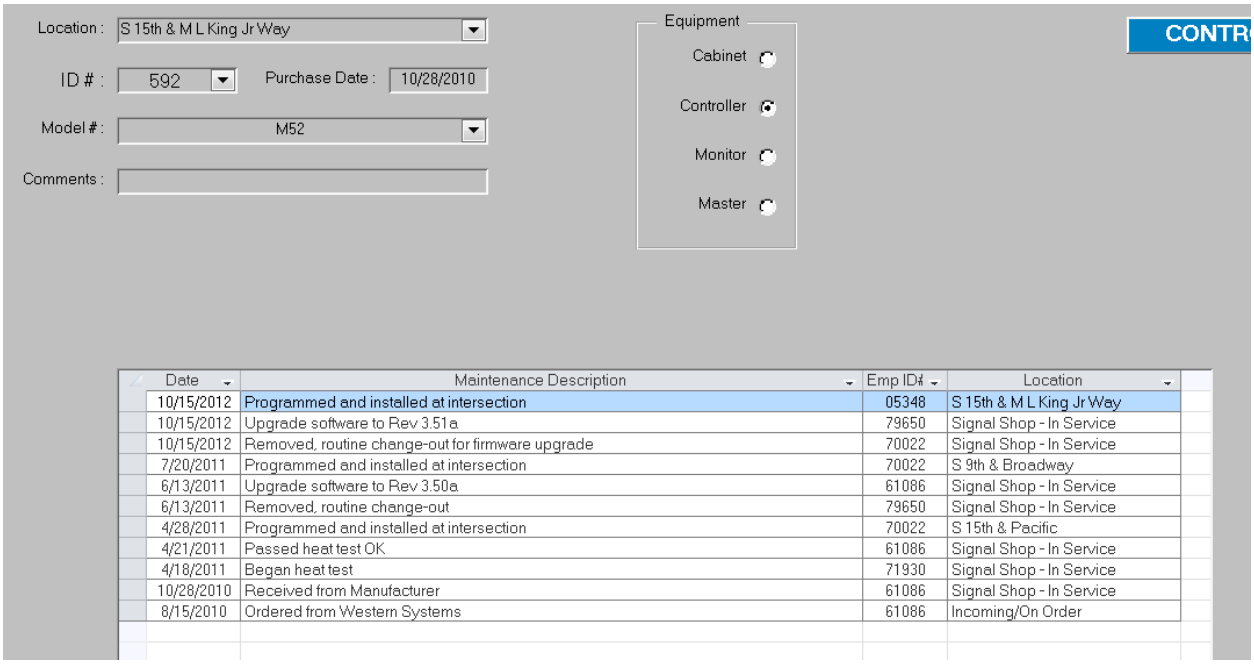


Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	E S Brazill & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
10/15/2012	Removed, routine change-out for firmware upgrade	70022	Signal Shop - In Service
6/18/2011	Programmed and installed at intersection	15957	S 10th & Yakima
6/14/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/13/2011	Removed, routine change-out	79650	Signal Shop - In Service
4/20/2011	Programmed and installed at intersection	70022	S 13th & Fawcett
4/18/2011	Passed heat test OK	71930	Signal Shop - In Service
4/14/2011	Began heat test	71930	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

MLK/15th

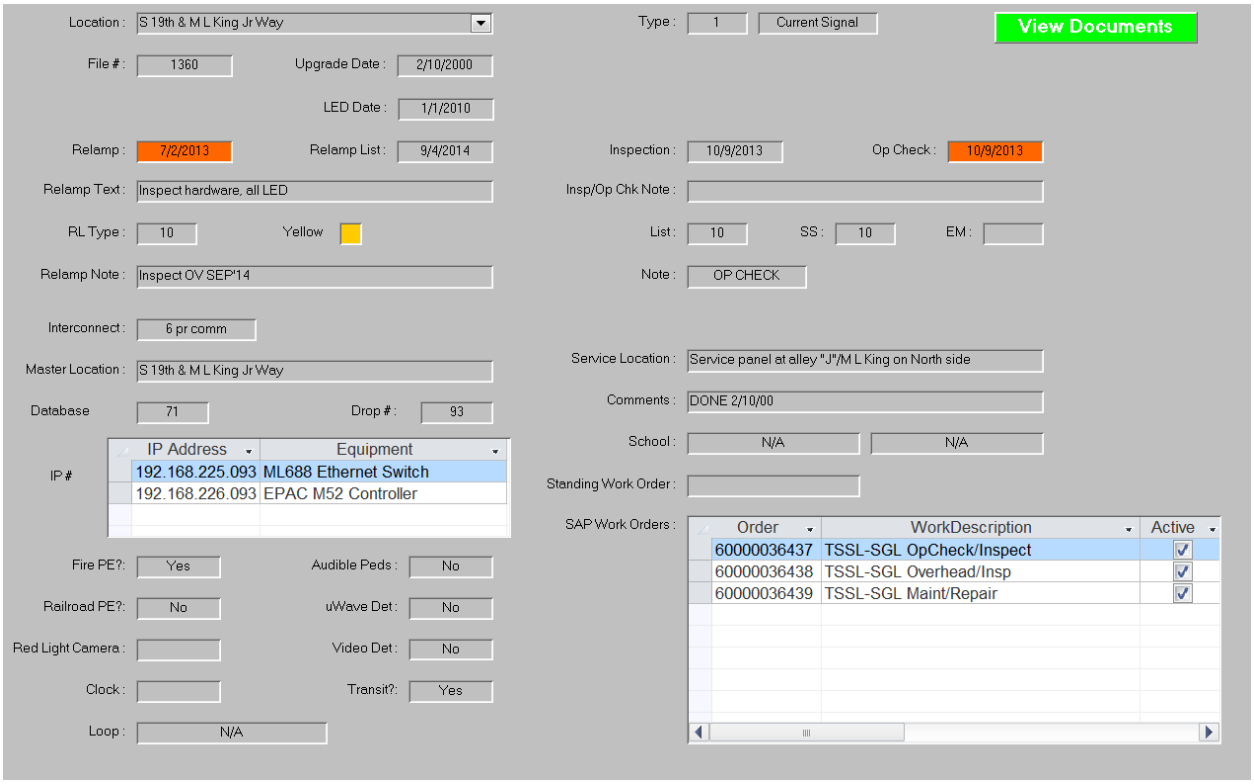

Location : S 15th & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 1190
Upgrade Date : 3/15/2000
LED Date : 3/26/2008
Relamp : 6/8/2014
Relamp List : 8/10/2015
Inspection : 10/9/2013
Op Check : 10/9/2013
Relamp Text : Skip this cycle, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : SKIP JUN'14
Note : OP CHECK
Interconnect : 6 pr comm
Master Location : S 15th & M L King Jr Way
Service Location : North side of S 15th at the alley East ("J"/ML King)
Database 71
Drop # : 78
Comments : DONE 3/15/00
School : N/A N/A
IP #
IP Address Equipment
192.168.225.078 ML688 Ethernet Switch
192.168.226.078 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
Fire PE?: No
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: No
Loop : N/A

Location : S 15th & M L King Jr Way
Cabinet ID : 402
Make : 390
Size : P
Print # :
Purchased For : S 15th & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : S 15th & M L King Jr Way
Manufacturer : IDC
Purchase Date : 10/27/1999
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : Detector Relay
MUTCD Flash : All Red
Single Ch : 0
Orig Controller : 331
Pre-empt Type :
Dual Ch : 0
Original CMU : 362
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : None
Ch's of Detection : 30
Loadswitch : 8

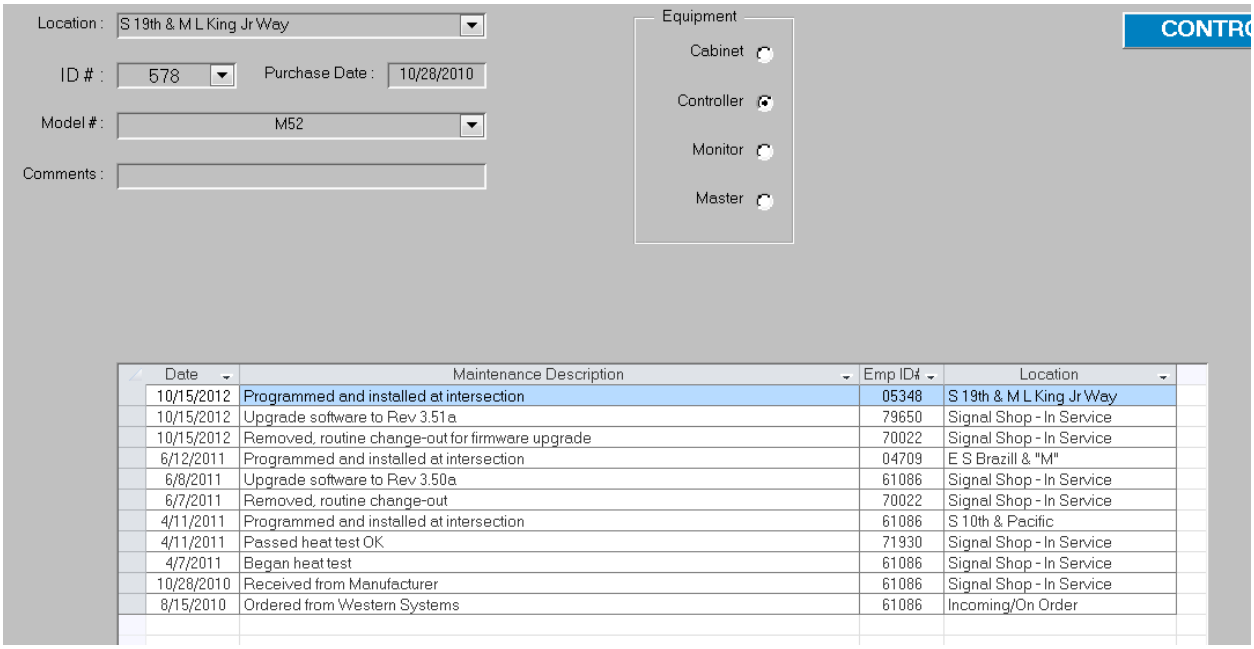


Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	S 15th & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
10/15/2012	Removed, routine change-out for firmware upgrade	70022	Signal Shop - In Service
7/20/2011	Programmed and installed at intersection	70022	S 9th & Broadway
6/13/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/13/2011	Removed, routine change-out	79650	Signal Shop - In Service
4/28/2011	Programmed and installed at intersection	70022	S 15th & Pacific
4/21/2011	Passed heat test OK	61086	Signal Shop - In Service
4/18/2011	Began heat test	71930	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

MLK-19th


Location : S 19th & M L King Jr Way
Type : 1 Current Signal
View Documents
File # : 1360
Upgrade Date : 2/10/2000
LED Date : 1/1/2010
Relamp : 7/2/2013
Relamp List : 9/4/2014
Inspection : 10/9/2013
Op Check : 10/9/2013
Relamp Text : Inspect hardware, all LED
Insp/Op Chk Note :
RL Type : 10
Yellow
List : 10
SS : 10
EM :
Relamp Note : Inspect OV SEP'14
Note : OP CHECK
Interconnect : 6 pr comm
Service Location : Service panel at alley "J"/M L King on North side
Master Location : S 19th & M L King Jr Way
Comments : DONE 2/10/00
Database 71
Drop # : 93
School : N/A N/A
IP #
IP Address Equipment
192.168.225.093 ML688 Ethernet Switch
192.168.226.093 EPAC M52 Controller
Standing Work Order :
SAP Work Orders :
Order WorkDescription Active
60000036437 TSSL-SGL OpCheck/Inspect
60000036438 TSSL-SGL Overhead/Insp
60000036439 TSSL-SGL Maint/Repair
Fire PE?: Yes
Audible Peds : No
Railroad PE?: No
uWave Det : No
Red Light Camera :
Video Det : No
Clock :
Transit?: Yes
Loop : N/A

Location : S 19th & M L King Jr Way
Cabinet ID : 407
Make : 390
Size : P
Print # :
Purchased For : S 19th & M L King Jr Way
Print FileName :
Comments :
Shop Location : Remote Location
From : S 19th & M L King Jr Way
Manufacturer : IDC
Purchase Date : 11/3/1999
Clock Data
Clock Type #1 : TMP-390
Circuit #1 : N/A
CMU Card : STANDARD
Clock Type #2 : TMP-390
Circuit #2 : N/A
Conflict Flash : All Red
Clock Type #3 : TMP-390
Circuit #3 : Detector Relay
MUTCD Flash : All Red
Single Ch : 0
Orig Controller : 336
Pre-empt Type :
Dual Ch : 0
Original CMU : 354
Status : FIELD
Rack Card : 0
Det Rack? : Yes
PE Rack Type : CS-4
Ch's of Detection : 30
Loadswitch : 8



Date	Maintenance Description	Emp ID#	Location
10/15/2012	Programmed and installed at intersection	05348	S 19th & M L King Jr Way
10/15/2012	Upgrade software to Rev 3.51a	79650	Signal Shop - In Service
10/15/2012	Removed, routine change-out for firmware upgrade	70022	Signal Shop - In Service
6/12/2011	Programmed and installed at intersection	04709	E S Brazill & "M"
6/8/2011	Upgrade software to Rev 3.50a	61086	Signal Shop - In Service
6/7/2011	Removed, routine change-out	70022	Signal Shop - In Service
4/11/2011	Programmed and installed at intersection	61086	S 10th & Pacific
4/11/2011	Passed heat test OK	71930	Signal Shop - In Service
4/7/2011	Began heat test	61086	Signal Shop - In Service
10/28/2010	Received from Manufacturer	61086	Signal Shop - In Service
8/15/2010	Ordered from Western Systems	61086	Incoming/On Order

Appendix B
Tacoma Link Expansion Transportation Technical Analysis Methodology Report

July 2014

TACOMA LINK EXPANSION

Transportation Technical Analysis Methodology Report

SOUNDTRANSIT

CENTRAL PUGET SOUND
REGIONAL TRANSIT AUTHORITY

Tacoma Link Expansion

Transportation Technical Analysis Methodology Report

Prepared for:
Sound Transit

Prepared by:
CH2M HILL

July 2014

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Acronyms and Abbreviations

FTA	Federal Transit Administration
I-705	Interstate 705
LOS	level of service
MAP-21	Moving Ahead for Progress in the 21st Century
MLK	Martin Luther King
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
PSRC	Puget Sound Regional Council
SEPA	State Environmental Policy Act
TLE	Tacoma Link Expansion
v/c	volume to capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled
WSDOT	Washington State Department of Transportation

Introduction

This report describes the methods that will be used to analyze the effects on the transportation system as a result of the Tacoma Link Expansion (TLE). The transportation analysis for the project will identify and evaluate the project impacts for the following topics:

- Regional motorized and transit system, including ridership and mode share
- Transit service
- Intersection level of service (LOS)
- Parking
- Bicycle and pedestrian circulation around stations
- Freight movement
- Safety
- Construction impacts

Tacoma Link Expansion Project Description

The TLE would improve access and mobility in the regional transit system by connecting Tacoma's Central Business District to the Hilltop Business District and four major hospitals/medical centers. The project would also provide opportunities for economic development. The TLE is expected to operate about 17 hours per day (from 6:30 AM to 10:00 PM), offering service every 10 minutes during peak periods and every 20 to 24 minutes during off-peak periods.

The TLE project would extend the existing Tacoma Link System by an additional 2.4 miles, with the new alignment continuing north from the existing Theater District Station along Stadium Way, North First Street, Division Avenue, and Martin Luther King, Jr. Way (Figure 1). The trackway would be located within existing public right-of-way and streetcar vehicles would share lanes with traffic. Stations would be located along the alignment and also within the existing public right-of-way, either as side platforms that are incorporated into the existing sidewalk or as median stations. Other elements of the TLE include traction power substations, which would be located close to the streetcar alignment, and the overhead catenary system with poles located approximately every 100 feet to supply electricity to the streetcars.

The TLE project would also involve expanding the existing Operations and Maintenance Facility (OMF) (Figure 1) because of the additional streetcar vehicles, which would require additional storage and track space. The expansion of the OMF would occur on property adjacent to the existing OMF and would require property acquisition.

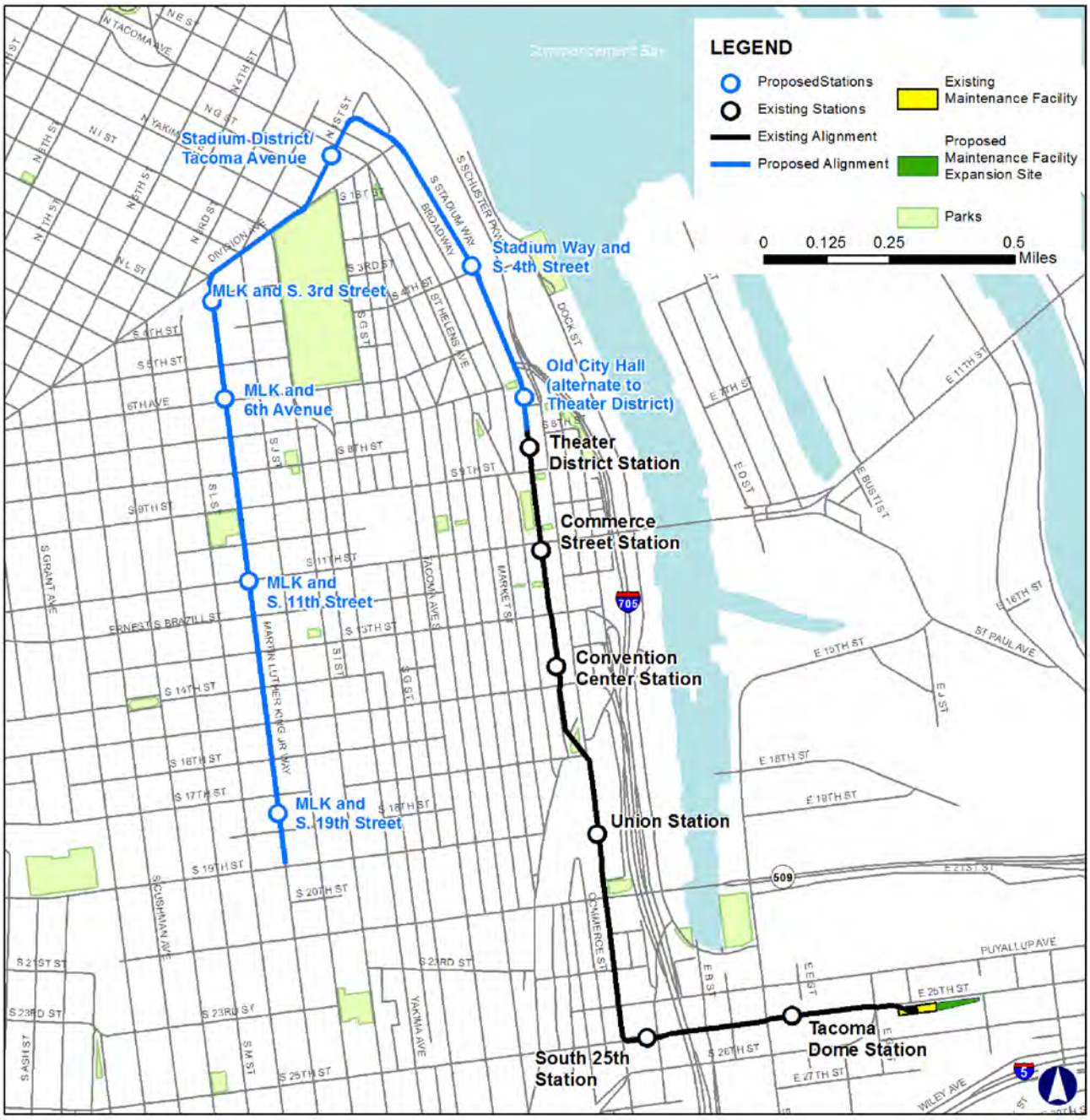

Figure 1. Alignment of Tacoma Link Expansion

Guiding Regulations and Plans

The transportation analysis will be guided by the following laws and regulations:

- National Environmental Policy Act (NEPA);
- State Environmental Policy Act (SEPA); and
- Moving Ahead for Progress in the 21st Century (MAP-21);

In addition to the laws and regulations identified above, analysis of local transportation impacts will be guided by the policy direction established in the numerous plans or policy documents adopted within the project corridor. These include, but are not limited to:

- Sound Transit 2 (ST2)
- Washington Transportation Plan 2007–2026 (Washington State Transportation Commission and Washington State Department of Transportation [WSDOT] 2007)
- WSDOT Design Manual (2013)
- WSDOT Development Services Manual (2005)
- Puget Sound Regional Council (PSRC) Transportation 2040: Toward a Sustainable Transportation System (2010)
- Comprehensive Plans and Transportation Plans for the City of Tacoma and Pierce County.
- City of Tacoma Municipal Code

Agency Coordination

The transportation planning and analysis process will involve local jurisdictions, state agencies, federal agencies, transit agencies, PSRC, and other interested parties. The Federal Transit Administration (FTA) will be the lead agency for the development of environmental documentation in accordance with NEPA regulations. For the development of the transportation technical report, Sound Transit will meet with and provide opportunities for coordination with the following agencies:

- City of Tacoma
- WSDOT
- PSRC
- Pierce County
- Pierce Transit

Project Overview

This project will assess the transportation conditions and impacts associated with the TLE in the City of Tacoma.

Project Area and Study Intersections

The project area is generally bound by 19th Street to the south, Commerce Street-Stadium Way to the east, North 1st Street and Division Avenue to the north, and Martin Luther King Jr. Way to the west. The TLE proposed alignment (Figure 1) extends the existing Tacoma Link track alignment along Commerce Street to the north of 9th Street until it merges with Stadium Way. The alignment will then extend along Stadium Way until North 1st Street, and then extend along 1st Street until it merges with Division Avenue near the intersection of Yakima Avenue and Division Avenue. The alignment extends along Division Avenue until it reaches Martin Luther King Jr. Way. It then proceeds along Martin Luther King Jr. Way until it reaches the end of the proposed alignment near 19th Street.

Up to six new stations are proposed along the alignment, while a southbound platform may be added at the existing Theater District Station. General station locations have been identified and will be finalized prior to completion of the traffic analysis.

The project area includes a total of 21 main (Tier 1) study intersections and 6 secondary (Tier 2) study intersections. Three-hour intersection turning movement counts will be collected during the spring of 2014 for both the Tier 1 and Tier 2 study intersections during the PM peak hour. The turning movement counts will include cars, trucks, bicycles, pedestrians, and transit vehicles. The 21 main study intersections will be evaluated as part of the traffic analysis associated with the TLE. If the traffic analysis determines that impacts in the form of traffic diversion or oversaturated conditions are expected at the main study intersections, then the six secondary intersections may be added to the traffic analysis. The study intersections are listed in Table 1 and shown in Figure 2.

Data Needs and Sources

A variety of data will be collected and assembled to analyze the transportation-related effects of the project. These data sets will include the following:

Traffic, Engineering, and Crash Data

- Existing (2014) 3-hour PM peak hour turning movement counts
- Existing lane geometry, channelization, and “as-built” plans
- Daily traffic counts as available from local jurisdictions
- Crash data for last 5 years at study intersections
- Existing truck routes, truck restrictions, and volume data where available

Signal Timing and Controller Data

- Existing signalized intersection timing plans
- Signal controller type, cabinet type, and capacity for added detection/preemption
- Communication links between signalized intersections
- Central signal system in use for each signal

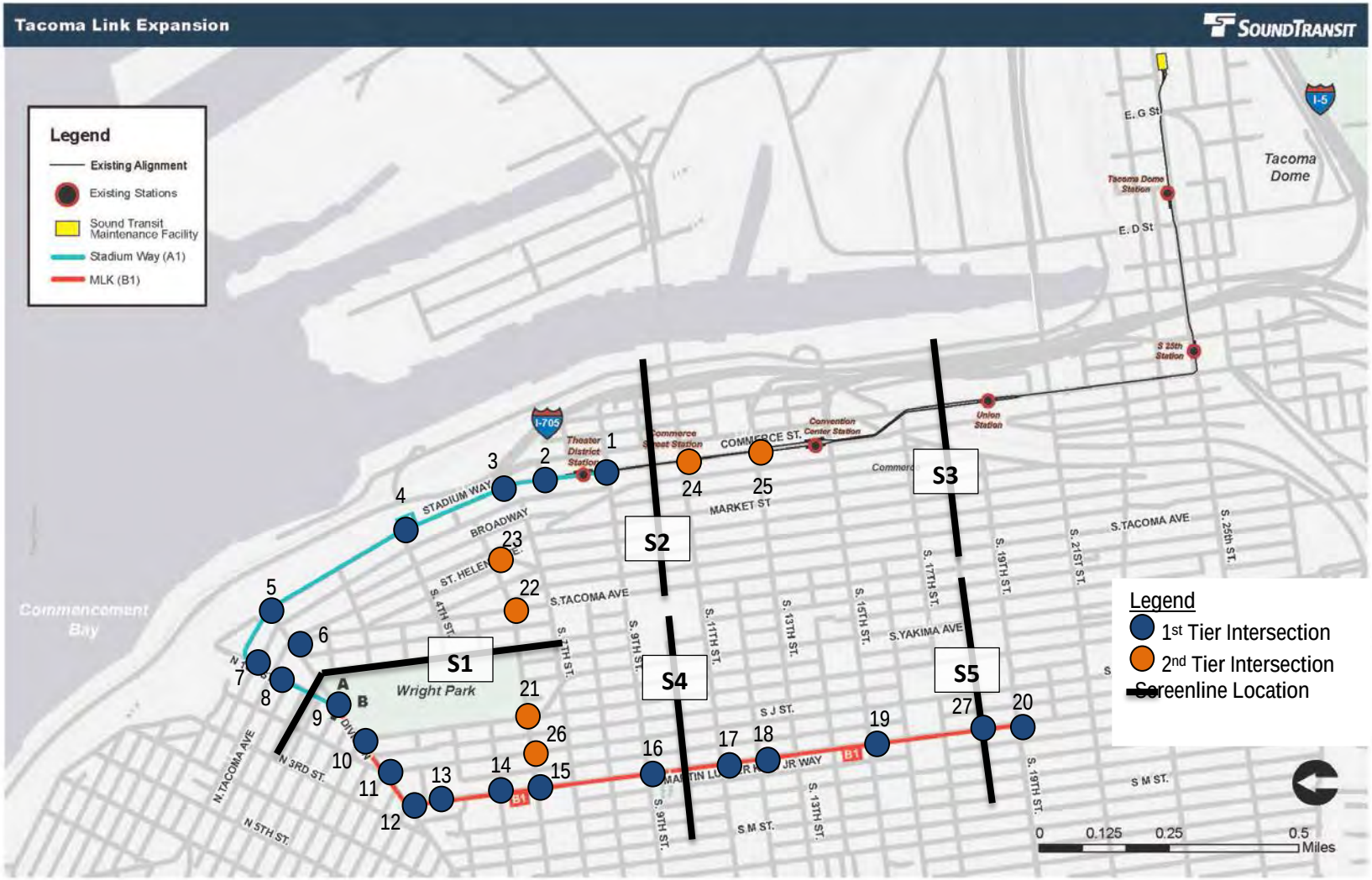

Figure 2. Tacoma Link Expansion: Project Area, Study Intersections, and Analysis Screenlines

TABLE 1
Tacoma Link Expansion Study Intersections

ID	Intersection	Control	Tier
1	Commerce Street/9th Street	Signal	1st Tier
2	Commerce Street/7th Street	Stop	1st Tier
3	Stadium Way/I-705 Ramps [a]	Signal	1st Tier
4	Stadium Way/4th Street	Signal	1st Tier
5	Stadium Way/Division Avenue	Stop	1st Tier
6	Division Avenue/Tacoma Avenue	Signal	1st Tier
7	N 1st Street/Broadway Street	Stop	1st Tier
8	N 1st Street/Tacoma Avenue	Signal	1st Tier
9	N 1st Street/Division Avenue – Yakima Avenue	Signal	1st Tier
10	Division Avenue/I Street	Signal	1st Tier
11	Division Avenue/2nd Street – J Street	Stop	1st Tier
12	Division Avenue/K Street - MLK Way	Signal	1st Tier
13	MLK Way/3rd Street	Stop	1st Tier
14	MLK Way/5th Street	Stop	1st Tier
15	MLK Way/6th Street	Signal	1st Tier
16	MLK Way/9th Street	Signal	1st Tier
17	MLK Way/11th Street	Signal	1st Tier
18	MLK Way/Earnest S. Brazill	Signal	1st Tier
19	MLK Way/15th Street	Signal	1st Tier
20	MLK Way/19th Street	Signal	1st Tier
21	6th Street/I Street	Signal	2nd Tier
22	6th Street/Tacoma Avenue	Signal	2nd Tier
23	6th Street/St. Helens Avenue	Stop	2nd Tier
24	Commerce Street/11th Street	Signal	2nd Tier
25	Commerce Street/13th Street	Signal	2nd Tier
26	6th Street/J Street	Signal	2nd Tier
27	MLK Way/18th Street	Stop	1st Tier

Notes:

[a] WSDOT Highway of Statewide Significance Intersection
I-705 = Interstate 705
MLK = Martin Luther King

Transportation Plans and Studies and Planned Improvements

- Recent traffic analysis reports and traffic models completed within the study area
- Existing and future planned transit services and nonmotorized plans
- Planned and programmed transportation network improvements within the study area for the forecast year (2035)

- Relevant state, regional, and local transportation planning documents

Transit Data

- Transit route service area and hours of service

Parking

- Supply and demand inventory of on- and off-street public parking facilities along one side-street adjacent to the proposed alignment

Nonmotorized

- Inventory of existing and planned walk and bicycle facilities within 0.5 and 1 mile of each potential station area, respectively
- Pedestrian and bicycle volumes at study intersections

Data not available from local jurisdictions will be supplemented by field visits.

Alternative Scenarios and Analysis Years

As part of this study, a PM peak hour Synchro operational traffic analysis model will be developed for the following scenarios:

- 2014 Existing Conditions
- 2035 Forecast Year "No Build"
- 2035 Forecast Year "Build"

For the year 2035, a No-Build and Build condition will be analyzed. The Build option will be based on the proposed track and station design. An interim terminus condition assuming the Tacoma Link alignment would terminate at South 11th Street may also be analyzed as a subset of the 2035 Build scenario. The extension to South 19th Street would be assumed for the full build condition.

Modeling Methodology

The transportation analysis will use two regional travel demand models to support the assessment of future conditions, which includes developing transit ridership forecasts and future roadway traffic volumes. The Sound Transit Ridership Model will be used to produce ridership forecasts, and the Pierce County model will be used to calculate growth in vehicular traffic volumes to support traffic operations analysis, as well as data required for a variety of environmental analyses.

Forecasting Models

Sound Transit Incremental Ridership Model

The Sound Transit ridership model uses data from the PSRC modeling process to establish measures of change in external factors, including population and economic growth, and highway congestion. For more detailed information about the Sound Transit Incremental Ridership Model, see the *Transit Ridership Forecasting Technical Report* (Sound Transit 2013). This current model version is based on the year 2011, using observed transit ridership data and survey data within the general incremental modeling framework. Population and employment estimates are provided by PSRC. The Sound Transit model will be used to produce rail and bus ridership forecasts for this project.

Regional and Arterial Travel Demand Model

The Pierce County-City of Tacoma city-wide model, currently in development as part of the City of Tacoma Master Plan, is the regional and arterial travel demand model proposed for use on this project. If this model is not ready by May 15, 2014, the project team will use the Pierce County model that was used for the Pacific Avenue Streetscape project in 2011. If the Pacific Avenue model is used, existing volumes will be compared with the updated City of Tacoma model (when ready) to confirm the model is within an acceptable tolerance. A tolerance of 15 percent for future year volumes at key screenlines along the corridor will be used to determine if the Pacific Avenue model is acceptable. If portions of the Pacific Avenue model are not acceptable, the operational analysis will be updated at key intersections along the corridor using data from the newly updated City of Tacoma model.

The travel demand model will be refined to reflect necessary network modifications specific to the project corridor, such as the background projects. The additional data in the model will provide a more detailed representation of the roadway network and travel patterns in the study area. Any modifications to lane use or transit would require modeling support and coordination from Pierce County.

Traffic Forecasting Methodology

Future Year Background Projects

The future travel demand forecasts and traffic analysis will be based on a background network of transportation projects for the horizon year (2035). These projects are documented in the relevant agency transportation plans within the study area, including the City of Tacoma Six-Year Transportation Improvement Program (2013/2014 and 2015-2020) (City of Tacoma 2013), Sound Transit's ST2 Plan (Sound Transit 2008), and 2007-2026 WSDOT Highway System Plan (WSDOT 2006). A review of the future year travel demand models will confirm that regionally significant projects are included in the model.

In addition to regionally significant projects, the following local jurisdiction transportation improvements in the study area are assumed for the year 2035 No-Build and Build alternatives for the transportation analysis. These projects include the following:

- Thea Foss – Public Parking – 15th and Hood (public parking) – THE-NEW-931
- Schuster Parkway Trail (Nonmotorized) – CIP-NEW-1072
- Prairie Line Trail Phase 1 (Nonmotorized) – PWK-00215
- Pacific Avenue Streetscape (Nonmotorized) – PWK-00234
- 17th Street Extension and UWT Improvements – PWK-NEW-1131

These projects will be incorporated, where appropriate, into the travel demand and operations models. Because the TLE project may be submitted to the FTA and other agencies for potential funding, the project's future year conditions assume that all fully funded projects will be constructed prior to the TLE.

Existing Highway Conditions

Peak hour roadway and intersection turning movement volumes will be compiled from existing traffic volume counts. These will form the basis upon which traffic volumes for the future analyses will be developed. It is assumed that existing travel demand models will be reasonably calibrated and validated against existing traffic volumes.

Future No-Build (Baseline) Highway Conditions

For the future No-Build conditions, growth rates derived from the travel demand model will be applied to traffic volume counts to develop estimated future PM peak hour and daily traffic forecasts. Year 2035 forecasted traffic volumes will be reviewed and post-processed following guidelines outlined in National Cooperative Highway Research Program (NCHRP) 255.

Future Build Highway Condition(s)

The travel demand model will be used to generate regional traffic volumes for the Build condition and will be adjusted based on the transit ridership forecasts developed for the Build Alternative from the Sound Transit Incremental Ridership Model. The projected changes to transit demand associated with the project alternatives will be incorporated into the travel demand model to reflect travel pattern and volume effects from changes in transit ridership. This approach will only be used to determine regional travel elements, such as vehicle miles traveled (VMT) and vehicle hours traveled (VHT), and not for detailed intersection LOS.

For traffic volumes used in the operational analysis at the arterial and local level in the Build Alternative (i.e., intersection LOS), the traffic volumes for the No Build condition will be used as a base. After an initial assessment of streetcar operations, if any impacts that cause intersection LOS to degrade beyond the allowable LOS standard, then potential traffic shifts to parallel corridors will be conducted and assessed. Engineering judgment will be used to determine the amount of vehicles that could potentially be diverted. Any associated impacts would be incorporated into a further refined analysis.

Station Area Trip Generation

Information on trip generation for the streetcar transit stations will be developed from the Sound Transit Incremental Ridership Model and will be assigned to various modes of travel. Due to the characteristics of the proposed stations, only bus transfer and walk/bike access trips are anticipated and no vehicular trip generation is expected.

The pedestrian trips associated with the streetcar station ridership forecasts will be used for evaluating the station area effects. Trips will be assigned to the pedestrian networks within 300 feet of the station locations based on existing and anticipated future circulation patterns. Impacts on adjacent intersections will be reflected in the intersection LOS analysis, and impacts on pedestrian facilities will be documented qualitatively.

Screenline Analysis

A screenline-level analysis will be used to evaluate effects along corridors and/or a subarea of the study area. Screenlines are imaginary lines drawn across multiple roadways to compare aggregate

changes in traffic conditions. Data that will be included for each screenline include PM peak hour and daily vehicle volumes; vehicle volume-to-capacity (v/c) ratios; and mode share.

The five screenlines, which are previously shown in Figure 2, are:

- Screenline S1—G Street between North 3rd Street and South 7th Street
- Screenline S2—South 10th Street between Dock Street and South Tacoma Ave
- Screenline S3— South 18th Street between Dock Street and South Tacoma Ave
- Screenline S4— South 10th Street between South Tacoma Ave and M Street
- Screenline S5— South 18th Street between South Tacoma Ave and M Street

Information for each screenline will be generated from the project's travel demand model and Sound Transit ridership model. Additional details about these models are provided in later sections of this document.

Analysis to Support Environmental Documentation

Transit Analysis

Transit Service Area and Circulation

The transit service and circulation assessment will analyze the expected project effects on the existing and future bus and light rail services within the TLE study area and may use both qualitative and quantitative information. Transit service information will either be reported at the screenlines, or at station areas within the TLE study area.

Transit Ridership

The Sound Transit Incremental Ridership Model that has been recently refined through other Sound Transit projects will be used to perform the transit ridership (bus and light rail) forecasts for the future horizon year of 2035.

The transit system, which may include modifications to light rail and bus service, will be coded for the No-Build and Build alternatives to produce transit ridership forecasts. The model may also be used to develop ridership forecasts for up to two interim terminus Build scenarios.

Operational Analysis

Traffic Analysis Software

The study area intersections will be analyzed using Synchro, Version 8, to provide LOS, average vehicle delay, volume-to-capacity ratios, travel times, and queuing results. The signalized intersections LOS will be defined in terms of average intersection delay by intersection approach. The LOS at unsignalized intersection will also be defined in terms of delay, but only for the worst operating movement, which is typically on the minor (stop-controlled) street. Synchro parameters for the intersection analysis are detailed in Table 2.

In addition to the Synchro operational analysis, the microsimulation traffic analysis tool, VISSIM, may be used to assess transportation and transit operations for key areas along the proposed alignment. VISSIM has the capability to provide an enhanced level of detail when modeling transit stops, signal controllers with transit priority, exclusive transit phases, and modeling the effects of streetcar

operations in a multimodal (auto, bus, and nonmotorized) system. If the Synchro analysis shows poor operations or is unable to accurately assess streetcar operations, then VISSIM may be used to analyze key intersections or segments along the TLE alignment where analysis refinements may be required.

Agency LOS Standards

WSDOT and the City of Tacoma maintain intersection LOS standards for intersections in the study area. For state highways of statewide significance, such as the Interstate 705 ramp terminals, WSDOT has an operating threshold of LOS D. For this project, the City of Tacoma has also established an LOS D standard for all study intersections and this standard is to be analyzed by intersection approach.

The City of Tacoma has recently adopted the North Downtown and Hilltop Subarea Plans, which recommend implementing an LOS E standard for intersection operations. Although LOS D is the current local standard, if there is deficient intersection or approach operating at LOS E, then the project team will work with the City to determine whether any mitigation is required. Specific approaches or intersections that operate at LOS F could be subject to mitigation.

Traffic Analysis

A PM peak hour Synchro model will be developed to assess intersection LOS for existing conditions, and the 2035 No-Build and Build alternatives. For the Build analysis, two Synchro models may be developed. The first model would analyze conditions when a streetcar is not in the system, while the other model would assess conditions with a streetcar present. The latter model may include elements associated with Tacoma Link operations, such as transit signal priority, exclusive transit-only phases where necessary, and delay associated with station areas. A weighted average of vehicle delays from the two models will be used to develop the Build Alternative LOS. If the analysis indicates signal coordination must be broken, then a modified approach may be required.

Travel times for automobiles and streetcars will also be assessed as part of the traffic analysis. The traffic analysis will also consider whether the streetcar will have to operate at slower than posted speed limits and would be included in the analysis.

Safety Analysis

Potential effects of the project on safety will be assessed quantitatively and qualitatively for all modes within the study area, including general traffic, transit, freight, bicycle, and pedestrian modes. Elements of the safety analysis include the following:

- Documentation of existing intersection crash histories based on type, severity, and frequency; and
- Qualitative effects on general purpose traffic, transit, freight, and nonmotorized safety in the No Build and Build alternatives.

Historic crash-rate summaries will be based on the most recent 5 years of crash data available from the City of Tacoma. For future year conditions, a qualitative assessment of safety will be discussed describing how the project may affect the existing crash type, and frequency will be documented. Interactions between the streetcar and other modes of travel (i.e., car, bicycle, walk, transit) will also be qualitatively discussed.

TABLE 2
Synchro Operations Parameters/Assumptions

Arterial Intersection Parameters	Condition	
	2014 – Existing	2035 – Design Year
Peak Hour Factor (by intersection)	From count, otherwise: If Total Entering Vehicles ≥ 1000, 0.92 If Total Entering Vehicles <1000, 0.90	Use 0.95 for all intersections except where existing Peak Hour Factor (PHF) is greater than 0.95. Use existing PHF in cases where the PHF is greater than 0.95
Conflicting Bikes and Pedestrian per Hour	From count, default provided, assume 10 peds/bikes	No-Build: Apply growth rate from adjacent street to existing volumes. Build: Add the number of pedestrians based on the station ridership and mode of access forecasts to No-Build volumes.
Area Type	Central Business District	Central Business District
Ideal Saturation Flow Rate (passenger cars per hour per lane)	1900	No Build: 1900 Build: 1900 or may modified to account for light rail stations adjacent to study intersections.
Lane Width	From field/as-built plans, otherwise 12 feet	Same as existing or design drawings, otherwise 12 feet.
Percent Heavy Vehicles	Per traffic count, otherwise 3%.	Same as existing
Parking Maneuvers per Hour	Based on parking regulations. For less than 15-minute parking, assume 4 maneuvers per hour; otherwise, assume 1 maneuver per hour.	Same as existing. For new parking, assume existing assumptions for maneuvers based on parking durations.
Bus Blockages	Headway information provided by transit agencies	Use future service assumptions developed by Pierce Transit and Sound Transit as part of the transit service integration plan.
Intersection Signal Phasing	Per actual signal timing	No Build: Same as existing or future background projects. Build: Any left-turn conflict with at-grade light rail will include a separate lane and/or have protected phasing.
Intersection Signal Timing Optimization Limits	Per actual signal timing	No Build: Same as existing but will modify splits to account for expected traffic conditions. Build: Same as existing but will modify splits to account for expected traffic conditions. Will maintain existing cycle lengths wherever possible. If streetcar required changes to cycle length, then will coordinate with City of Tacoma on appropriate timing assumptions.
Minimum Green Time	Based on field and/or signal timing plans	Based on field signal timings. If geometry changes, assume 6 seconds for protected and protected/permitted phasing left turns.
Yellow (Y) and All-Red (R) Time	Based on field and/or signal timing plans, otherwise Y = 4 seconds and R = 1 second.	Same as existing. New signals will be Y = 4 seconds and R = 1 second.
Pedestrian Walk/FDW	Based on field signal timings.	Same as existing. For new signals, based on MUTCD (2009). Slower walk speeds may be considered for intersections adjacent to medical facilities

FDW = Flashing Don't Walk; MUTCD = Manual on Uniform Traffic Control Devices; PFH = Peak Hour Factor

Parking Analysis

The evaluation of parking impacts will include an inventory of parking supply in locations where parking is anticipated to be affected by the project. A parking inventory survey will be conducted for the potential streetcar alignment that is within the road right-of-way and along one adjacent street.

Along the alignment and along one adjacent street, a parking supply and demand survey will be collected during a weekday AM peak period (7:00 AM to 10:00 AM) and PM peak period (3:00 PM to 6:00 PM). The parking supply will include documenting the type of parking (angle and/or parallel), time of day restrictions, load zones, residential permit parking, and pay parking. The parking demand will collect the number of occupied stalls along each block in the parking analysis area and will be used to determine percent utilization. AM and PM peak demand will be collected on the same day.

Where available, data from local agencies will be used to initiate the inventories near the streetcar alignments and station locations. If parking data are not provided by local agencies, the parking inventory will be completed through a field survey. Removal or relocation of parking due the project would be documented.

Nonmotorized

The nonmotorized evaluation will assess the bicycle and pedestrian facilities surrounding the proposed station areas. A 0.5 mile walk shed and 1.0 mile bicycle shed analysis will be used to support the estimated bicycle/pedestrian demand at the stations. Existing and planned nonmotorized facilities will be inventoried by either field visits or available information from agencies (such as geographic information system [GIS] data) and mapped with the project alternative alignments.

General sidewalk conditions surrounding the station areas (within 500 feet) will be qualitatively assessed and checked for compliance with American with Disabilities Act (ADA) standards. The Tacoma Link Project could potentially address documented ADA deficiencies if Sound Transit is affecting sidewalks within the project footprint subject to negotiation between Sound Transit and the City of Tacoma.

Freight Analysis

A qualitative assessment of the freight conditions will be conducted within the study area. It will be based on existing and forecasted freight volumes, and designated freight routes and their connections to points of interest. This includes identification of any at-grade crossings and traffic impacts that would affect freight movements. A discussion of impacted freight delivery/load zones will be discussed qualitatively. Existing and planned freight routes will be mapped with the project alternative alignment.

Construction Analysis

The assessment of construction-related traffic impacts will be focused near station areas, along the alignment, or on streets that could be significantly affected by construction with the Build Alternative. A combination of quantitative and qualitative impacts will be assessed:

- Changes in roadway capacity, including potential lane/road closures, parking restrictions, pedestrian or bicycle facility impacts, alignment shifts, areas of construction activity adjacent to travel lanes, or other reductions to capacity as a result of project construction activity
- Impacts on school and emergency transportation services during construction
- Impacts of on- and off-street public parking supply, including temporary loss of spaces
- Identification of potential construction access and truck routes and the impact of construction-related traffic on these routes
- Assessment of potential for neighborhood traffic intrusion related to road closure and options for traffic detour
- Temporary impacts on ADA accessibility and facilities.

Mitigation

Potential mitigation measures will be described to address potential transportation impacts associated with the project.

- Local Traffic Impacts: Based on the 2035 traffic analysis, mitigation of long-term impacts will be identified for the intersections that do not meet the established LOS standards. For intersections that do not meet the established LOS standards in the No-Build condition, the Build Alternative is only obligated to bring the operating conditions back to the overall delay levels of the No-Build condition. For parking mitigation, Sound Transit will work with the City of Tacoma to identify potential mitigation for loss of parking, pedestrian safety, and ADA access as necessary.
- Construction: Mitigation measures aimed at addressing the construction traffic impacts during the year 2018 construction scenario will be developed and reviewed. Mitigation measures identified to address local construction traffic impacts will be reviewed for their relevancy in addressing regional and/or corridor-level construction traffic issues.

Measures of Effectiveness

The following performance measures will be collected for each of the analysis scenarios to compare between alternatives. Table 3 shows the various measures of effectiveness by element:

TABLE 3
Transportation Measures of Effectiveness

Assessment Level	Type of Analysis	Criteria
Regional	Transit	Systemwide annual and daily transit trips and boardings, total annual and daily light rail boardings
	Traffic	Growth rate, VMT, and VHT
Corridor and Subarea	Transit	Project-wide daily transit trips, station area boardings
	Traffic	Screenline volumes and v/c ratios

TABLE 3
Transportation Measures of Effectiveness

Assessment Level	Type of Analysis	Criteria
Arterials and Local Streets	Transit	Effects on local transit patterns and circulation
	Intersection	Intersection LOS, delay, travel times, v/c, and queue lengths.
	Safety	Quantitative: Historical intersection and roadway accident type and frequency Qualitative: Future year assessment of effects on auto, freight, transit, and nonmotorized modes
	Parking	On- and off-street public parking inventory, parking impacts, existing parking supply and demand along alignment.
	Nonmotorized	Pedestrian and bicycle access, circulation and gaps surrounding stations, access barriers
	Freight	Identification of freight routes and impacts, impacts on business loading zones and access.
	Construction	Qualitative: impacts on property access, nonmotorized, and parking. Quantitative: Estimation of construction-related traffic and truck routes.

v/c = volume to capacity
LOS = level of service
VHT = vehicle hours traveled
VMT =vehicle miles traveled

Deliverables and Review Schedule

The following deliverables will be compiled throughout this modeling effort:

- Existing and Future Year Traffic Forecasts
- Transit Ridership Forecast Results Technical Memorandum
- Draft Transportation Technical Report
- Final Transportation Technical Report

Each of the above deliverables will be submitted to the reviewers for review and comments. As part of the deliverable, any data collected, Synchro modeling files, and/or spreadsheet calculations will be provided with the technical documentation.

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Appendix C
Traffic Operational Measures of Effectiveness

TACOMA LINK EXTENSION
Existing Intersection Level of Sevice and Queue Lengths

ID	Intersection	Control	Approach	Approach Delay (sec/veh)[c]	Approach LOS	Intersection Delay (sec/veh)[c]	Intersection LOS	Lane Group	V/C	Storage[1]	95th Queue (ft)
						Average Hourly Operations					
1	Commerce/9th	Signal	EB	32	C	24	C	L/T/R	0.64	210	350
			WB	15	B			L/T/R	0.22	130	100
			NB	23	C			L/T/R	0.44	680	140
			SB	22	C			L/T/R	0.17	610	60
2	Commerce/7th Street	Unsignalized	WB	8	A	8	A	L/R	0.10	110	
			NB	7	A			T/R	0.08	610	
			SB	7	A			L	0.07	140	
								T[2]	0.10	200	
3	Stadium Way/I-705 Ramps	Signal	WB	8	A	21	C	L	0.17	300	50
								R	0.71	>2000	130
			NB	33	C			T/R[2]	0.58	120	90
			SB	34	C			L	0.98	205	650
								T	0.06	650	30
4	Stadium Way/4th Street	Signal	EB	41	D	14	B	L/R	0.16	140	70
			NB	11	B			L	0.42	175	150
								T	0.65	335	690
			SB	10	A			T/R	0.58	1500	530
5	Stadium Way/N E Street	Unsignalized	EB	33	D	33	D	L	0.08	130	10
								R	0.57	130	100
			NB	3	A			L	0.21	100	20
								T	0.29	1500	0
			SB	0	A			T/R	0.15	600	0
6	Division Ave/N Tacoma Ave	Signal	EB	35	D	38	D	L/T	0.85	650	510
								R	0.19	130	80
			WB	41	D			L/T	0.79	110	240
								R	0.05	110	20
			NB	43	D			L	0.79	90	220
								T/R	0.76	670	240
			SB	28	C			L	0.15	120	40
								T/R	0.46	310	150
7	1st Street/N Broadway St	Unsignalized	EB	15	B	15	B	L/T/R	0.08	320	10
			WB	15	B			L/T/R	0.05	420	10
			NB	0	A			L/T/R	0.00	90	0
			SB	0	A			L/T/R	0.01	600	10
8	1st Street/N Tacoma Ave	Signal	EB	29	C	31	C	L	0.55	90	110
								T/R	0.46	310	140
			WB	34	C			L	0.16	150	50
								T/R	0.69	330	200
			NB	34	C			L/T	0.69	130	200
								R	0.05	110	20
			SB	29	C			L	0.04	100	40
								T/R	0.78	100	460
9	Division Ave/N 1st Street	Signal	EB	19	B	13	B	L/T/R	0.09	300	40
			SB	16	B			T/R	0.49	280	130
			NEB	9	A			L	0.46	320	150
								T/R	0.37	320	250
			SWB	16	B			T/R	0.44	290	120
10	Division Ave/I Street	Signal	EB	14	B	15	B	L	0.52	150	150
								T/R	0.38	300	180
			WB	14	B			L	0.24	130	70
								T	0.59	360	340
								R	0.23	360	50
			NB	18	B			L	0.07	80	40
								T/R	0.61	520	290
			SB	18	B			L	0.64	100	200
								T/R	0.28	100	130
11	Division Ave/J Street	Unsignalized	EB	12	B	21	C	L/R	0.09	310	10
			NEB	9	A			L	0.02	130	10
								T/R	0.32	340	0
			SWB	9	A			L	0.04	90	10
								T/R	0.30	310	0
			NB	17	C			L/T/R	0.39	330	50
			SB	21				L/T/R	0.09	110	10
12	Division Ave/MLK Way	Signal	EB	9	A	11	B	L	0.06	150	20
								T/R	0.53	320	160
			WB	11	B			L	0.17	190	30
								T/R	0.69	350	220
			NB	12	B			L	0.17	120	40
								T/R	0.20	120	50
			SB	12	B			L/T	0.29	120	60
								R	0.02	50	20
13	Martin Luther King Way/ S 3rd St	Unsignalized	WB	10	B	10	B	L/T/R	0.05	300	10
			NB	0	A			L/T/R[2]	0.13	320	0
			SB	1	A			L/T/R	0.01	110	10
14	Martin Luther King Way/ S 5th St	Unsignalized	EB	15	B	16	C	L/T/R	0.32	300	40
			WB	16	C			L/T/R	0.20	120	20
			NB	0	A			L	0.00	140	0
								T/R	0.11	300	0
			SB	1	A			L	0.01	100	10
								T/R[2]	0.10	360	0
15	Martin Luther King Way/ S 6th Ave	Signal	EB	15	B	15	B	L/T/R	0.45	320	140
			WB	13	B			L/T/R	0.58	320	110
			NB	15	B			L	0.07	120	30
								T/R	0.20	320	70
			SB	17	B			L	0.14	140	40
								T/R	0.42	290	130

			Average Hourly Operations									
ID	Intersection	Control	Approach	Approach Delay (sec/veh)[c]	Approach LOS	Intersection Delay (sec/veh)[c]	Intersection LOS	Lane Group	V/C	Storage[1]	95th Queue (ft)
16	Martin Luther King Way/ S 9th St	Signal	EB	10	A	16	B	L/T/R	0.12	310	40
			WB	13	B			L/T	0.40	310	160
								R	0.02	310	20
			NB	13	B			L	0.08	130	20
								T/R	0.33	320	60
			SB	26	C			L	0.26	140	80
								T/R	0.48	320	180
17	Martin Luther King Way/ S 11th St	Signal	EB	17	B	18	B	L	0.11	130	30
								T/R	0.27	300	120
			WB	18	B			L	0.04	150	20
								T/R	0.39	300	140
			NB	14	B			L	0.05	170	30
								T/R	0.25	310	150
			SB	21	C			L	0.05	130	20
								T/R	0.39	310	160
18	Martin Luther King Way/ S Ernest Brazill	Signal	EB	16	B	21	C	L/T	0.28	300	110
								R	0.06	140	30
			WB	15	B			L/T/R	0.12	310	60
			NB	17	B			L	0.14	130	60
								T/R	0.25	310	130
			SB	31	C			L	0.00	130	10
								T/R	0.35	300	200
19	Martin Luther King Way/ S 15th St	Signal	EB	13	B	14	B	L	0.03	130	20
								T/R	0.21	290	80
			WB	14	B			L	0.04	140	20
								T/R	0.25	280	100
			NB	18	B			L	0.07	140	30
								T/R	0.27	310	90
			SB	12	B			L	0.09	120	20
								T/R	0.40	300	200
28	Martin Luther King Way/ S 17th St	Unsignalized	EB	12	B	12	B	L/T/R	0.05	290	10
			WB	12	B			L/T/R	0.13	280	20
			NB	8	A			L	0.01	100	10
								T/R	0.09	330	0
			SB	8	A			L	0.00	100	0
								T/R	0.17	300	0
27	Martin Luther King Way/ S 18th St	Unsignalized	WB	10	A	10	A	L/R	0.03	300	10
			NB	0	A			T/R	0.10	390	0
			SB	8	A			L	0.00	100	0
				0				T/R	0.21	330	0
20	Martin Luther King Way/ S 19th St	Signal	EB	11	B	20	C	L	0.20	110	50
								T/R	0.31	290	120
			WB	12	B			L	0.04	130	20
								T/R	0.39	290	150
			NB	22	C			L	0.16	120	60
								T/R	0.13	320	60
			SB	48	D			L	0.23	120	90
								T	0.29	300	130
								R	0.12	100	70

Notes:
1. Storage Length is equal to turn pocket storage length or distance to upstream intersection
2. Storage length is only measured to upstream crosswalk.

TACOMA LINK EXTENSION

Year 2035 No Build and Build Intersection Level of Service and Queue Impacts- Old City Hall Station

					Signal Operations								Queuing			
					2035 No Build				2035 Build						2035 No Build	2035 Build
ID	Intersection	Control	Approach	Volume (vph)	Approach Delay (sec/veh)[c]	Approach LOS	Intersection Delay (sec/veh)[c]	Intersection LOS	Approach Delay (sec/veh)[cd]	Approach LOS	Intersection Delay (sec/veh)[cd]	Intersection LOS	Lane Group	Storage[1]	95th Queue (ft)	95th Queue (ft)
1	Commerce/9th Street	Signal	EB	805	33	C	28	C	21	C	22	C	L/T/R	210	370	310
			WB	245	15	B			14	B			L/T/R	130	110	90
			NB	240	25	C			31	C			L/T/R	680	200	280
			SB	200	30	C			26	C			L/T/R	610	200	90
2	Commerce/7th Street	Unsignalized[d]	WB	80	8	A	8	A	11	B	11	B	L/R	110	N/A	10
			NB	95	8	A			0	A			T/R	610	N/A	0
			SB	215	8	A			8	A			L	60	N/A	10
3	Stadium Way/I-705 Ramps	Signal	WB	1080	14	B	24	C	16	B	23	C	L	300	120	160
													R	>2000	630	630
			NB	135	41	D			37	D			T/R[2]	120	120	120
			SB	980	34	C			29	C			L	205	690	690
													T[2]	650	40	40
4	Stadium Way/4th Street	Signal	EB	285	41	D	16	B	41	D	16	B	L/R	140	90	100
			NB	945	13	B			12	B			L	175	290	290
													T[2]	335	730	730
			SB	670	11	B			10	B			T/R	1500	640	640
5	Stadium Way/N E Street	Unsignalized	EB	430	36	E	36	E	36	E	36	E	L	130	20	20
													R	130	100	100
			NB	735	9	A			9	A			L	100	20	20
													T	1500	0	0
			SB	255	0	A			0	A			T/R	600	0	0
6	Division Ave/N Tacoma Ave	Signal	EB	535	37	D	39	D	37	D	39	D	L/T	650	490	490
													R	130	80	80
			WB	285	42	D			42	D			L/T	110	240	240
													R	110	20	20
			NB	455	44	D			44	D			L	90	230	230
													T/R	670	330	330
			SB	195	28	C			28	C			L	120	50	50
													T/R	310	160	160
7	1st Street/N Broadway St	Unsignalized	EB	40	17	C	17	C	17	C	17	C	L/T/R	320	10	10
			WB	35	17	C			17	C			L/T/R	420	10	10
			NB	235	0	A			1	A			L/T/R	90	10	10
			SB	485	0	A			0	A			L/T/R	600	10	10
8	1st Street/N Tacoma Ave	Signal	EB	275	31	C	37	D	44	D	52	D	L	90	250	200
													T/R	310	150	200
			WB	290	38	D			42	D			L	150	60	80
													T/R	330	230	340
			NB	265	36	D			34	C			L[3]	100	N/A	120
													T/R[2]	180	210	190
			SB	465	40	D			73	E			L	100	50	40
													T/R	100	520	460
9	Division Ave/N 1st Street	Signal	EB	100	23	C	14	B	22	C	19	B	L/T/R	300	60	60
			WB	385	20	B			24	C			T/R	280	140	180
			NB	775	9	A			14	B			L	320	170	170
													T/R	320	260	260
			SB	435	15	B			24	C			T/R	290	130	190
10	Division Ave/I Street	Signal	EB	765	16	B	19	B	18	B	30	C	L	150	250	260
													T/R	300	210	210
			WB	810	15	B			14	B			L	130	80	80
													T	360	390	400
													R	360	60	120
			NB	395	24	C			39	D			L	80	40	60
													T/R	520	320	540
			SB	370	27	C			80	E			L	100	230	220
													T/R	100	140	220
11	Division Ave/J Street	Unsignalized	EB	25	12	B	32	D	12	B	32	D	L/R	310	20	10
			NEB	605	9	A			9	A			L	130	10	10
													T	340	0	0
													R	100	N/A	0
			SWB	525	10	A			9	A			L	90	0	10
													T/R	310	0	0
			NB	200	21	C			20	C			L/T/R	330	70	70
			SB	65	32	D			32	D			L/T/R	110	20	20
12	Division Ave/MLK Way	Signal	EB	435	10	B	12	B	13	B	13	B	L	150	20	30
													T/R	320	190	340
			WB	540	13	B			14	B			L	190	40	50
													T/R	350	230	310
			NB	255	12	B			13	B			L	120	50	90
													T/R	120	60	130
			SB	120	12	B			14	B			L/T	120	80	140
													R	50	20	20
13	Martin Luther King Way/ S 3rd St	Unsignalized	WB	50	11	B	11	B	11	B	11	B	L/T/R	300	10	10
			NB	260	0	A			0	A			L/T/R[2]	320	10	0
			SB	145	0	A			1	A			L/T/R	110	10	0
14	Martin Luther King Way/ S 5th St	Unsignalized	EB	190	19	C	21	C	21	C	22	C	L/T/R	300	60	70
			WB	90	21	C			22	C			L/T/R	120	30	40
			NB	245	8	A			8	A			L	140	10	10
									0				T/R	300	0	0
			SB	195	8	A			8	A			L	100	10	10
									0				T/R[2]	360	0	0
15	Martin Luther King Way/6th Ave	Signal	EB	315	16	B	16	B	14	B	18	B	L/T/R	320	160	180
			WB	375	13	B			17	B			L/T/R	320	100	240
			NB	275	17	B			17	B			L	120	50	60
													T/R	320	120	160
			SB	315	18	B			26	C			L	140	40	60
													T/R	290	150	200
16	Martin Luther King Way/ S 9th St	Signal	EB	250	15	B	20	B	19	B	19	B	L/T/R	310	60	90
			WB	390	21	C			29	C			L/T	310	250	350
													R	310	20	20
			NB	410	17	B			15	B			L	130	60	70
													T/R	320	260	190
			SB	440	24	C			14	B			L	140	70	80
													T/R	320	260	280
17	Martin Luther King Way/ S 11th St	Signal	EB	225	22	C	18	B	33	C	19	B	L	130	60	100
													T/R	300	120	150
			WB	500	23	C			37	D			L	150	20	30
													T/R	300	160	220
			NB	390	6	A			6	A			L	170	10	20
													T/R	310	80	130
			SB	530	21	C			7	A			L	130	40	30
													T/R	310	370	200

TACOMA LINK EXTENSION

Year 2035 No Build and Build Intersection Level of Service and Queue Impacts- Old City Hall Station

					Signal Operations								Queuing			
					2035 No Build				2035 Build						2035 No Build	2035 Build
ID	Intersection	Control	Approach	Volume (vph)	Approach Delay (sec/veh)[c]	Approach LOS	Intersection Delay (sec/veh)[c]	Intersection LOS	Approach Delay (sec/veh)[cd]	Approach LOS	Intersection Delay (sec/veh)[cd]	Intersection LOS	Lane Group	Storage[1]	95th Queue (ft)	95th Queue (ft)
18	Martin Luther King Way/ Earnest S Brazill	Signal	EB	265	23	C	15	B	43	D	16	B	L/T	300	160	250
													R	140	30	40
			WB	85	19	B			29	C			L/T/R	310	70	90
			NB	395	17	B			8	A			L	130	60	60
													T/R	310	230	190
			SB	400	7	A			4	A			L	130	10	10
													T/R	300	60	140
19	Martin Luther King Way/ S 15th St	Signal	EB	180	20	B	13	B	34	C	16	B	L	130	40	50
													T/R	290	100	130
			WB	235	21	C			39	D			L	140	30	30
													T/R	280	140	180
			NB	330	12	B			3	A			L	140	20	20
													T/R	310	180	130
			SB	420	5	A			4	A			L	120	10	30
													T/R	300	40	110
28	Martin Luther King Way/ S 17th St	Signal[b]	EB	95	13	B	15	B	35	C	11	B	L/T/R	290	10	50
			WB	45	15	B			39	D			L/T/R	280	20	100
			NB	300	9	A			5	A			L/T/R	330	10	180
			SB	475	8	A			6	A			L	100	0	20
													T/R	300	10	220
27	Martin Luther King Way/ S 18th St	Signal[b]	WB	30	13	B	13	B	35	C	6	A	L/R	300	10	40
			NB	295	0	A			5	A			T/R	390	0	210
			SB	440	8	A			5	A			L/T	340	10	160
20	Martin Luther King Way/ S 19th St	Signal	EB	670	16	B	16	B	12	B	14	B	L	110	50	50
													T/R	290	160	140
			WB	715	16	B			12	B			L	130	30	30
													T/R	290	180	160
			NB	300	21	C			26	C			L	120	90	100
													T/R	320	140	150
			SB	480	13	B			14	B			L	120	50	50
													T	300	110	110
													R	100	10	30

Notes:

[1]Storage Length is equal to turn pocket storage length, distance to upstream intersection, or distance to mid block pedestrian crossing

[2]Storage length is only measured to upstream crosswalk.

[3] No NBL provided in No Build alternative.

[a]Movement over capacity. Queue could be longer than reported.

[b]Signal provided as part of the project

[c]Average vehicle delay is reported for the worst movement for OWSC and TWSC intersections.

[d]Results are weighted by the frequency of trains per hour (6 per direction) and the number of signal cycles during an hour.

[e]Converted from All-way stop control to One-way stop control.

TACOMA LINK EXTENSION

2035 Build Auto and Streetcar Travel Times- Old City Hall Station

2035 PM Peak Hour Build Travel Times - Auto

Direction	Distance (mi)	Running Time (sec)	Signal Delay (sec)	Queue Delay (sec)	Total Travel Time (sec)	Total Travel Time (min)	Avg Speed (mph)
Outbound[1]	**2.6**	**453**	**307**	**23**	**783**	**13.1**	**11.9**
No Build	*2.4*	*390*	*299*	*4*	*692*	*11.5*	*12.7*
Inbound[1]	**2.4**	**439**	**207**	**26**	**673**	**11.2**	**13.1**
No Build	2.4	387	244	2	634	10.6	13.9

Note: Travel time is recorded from 9th/Commence to 19th/MLK and only includes the travel time along the new alignment

[1] Results are weighted by the frequency of trains per hour (6 per direction) and the number of signal cycles during an hour.

2035 PM Peak Hour Build Travel Times - Streetcar

Direction	Distance (mi)	Running Time (sec)	Signal Delay (sec)	Queue Delay (sec)	Station Dwell Time (sec)	Total Travel Time (sec)	Total Travel Time (min)	Avg Speed (mph)
Outbound	**2.4**	**429**	**211**	**0**	**210**	**850**	**14.2**	**10.1**
Inbound	**2.4**	**441**	**124**	**0**	**210**	**775**	**12.9**	**11.4**

Notes:

Travel time is recorded from 9th/Commence to 19th/MLK and only includes the travel time along the new alignment

Streetcar travel times are likely conservative. Passive transit signal priority schemes, including offset optimization and coordination can only partially be modeled in Synchro. Signal delay times will likely be lower.

2035 PM Peak Hour Build Station Area Queuing Assessment

Station Area	Direction	Storage (ft)	Vehicle Queue Length (ft) 50th% Q	95th% Q
Old City Hall	Inbound[1]	110	60	100
	Outbound	90	30	60
Stadium Way and South 4th Street	Inbound	1500	250	420
	Outbound[2]	335	310	**550**
Stadium District	Inbound[3]	130	70	120
	Outbound	180	110	180
MLK Way and Division	Inbound	230	70	120
	Outbound	220	40	70
MLK Way and 6th Avenue	Inbound	280	70	120
	Outbound	270	80	120
MLK Way and South 11th Street	Inbound	300	120	190
	Outbound	240	180	**290**
MLK Way and South 19th Street	Inbound	N/A	0	0
	Outbound	260	130	210

[1]Distance measured to I-705 intersection

[2]Distance measured to upstream crosswalk s/o 4th Ave and Stadium intersection.

[3]Distance measured to G Street crosswalk.

Appendix D
Transit Integration Plan

Tacoma Link Expansion – Transit Integration Assessment

PREPARED FOR: Sue Comis, AICP – Sound Transit

PREPARED BY: Alec More and Hannah Baweja – HDR

DATE: January 16, 2015

1.0 Introduction

Sound Transit, in coordination with the City of Tacoma, Washington, is planning for the expansion of the current Tacoma Link streetcar system from the central business district terminus in Downtown Tacoma to the Stadium District and Hilltop neighborhoods, principally along Stadium Way, Division Avenue and Martin Luther King Jr. Way (hereafter MLK Way). This project, referred to as the Tacoma Link Expansion (TLE), plans to construct 2.4 miles of bi-directional streetcar trackway add six new stations, and relocate one existing station. This memorandum discusses a preliminary transit integration plan to coordinate existing bus service provided by Pierce Transit with the proposed system expansion. The goal is to provide a seamless, complementary transit network serving the transportation needs of Tacoma residents and visitors.

1.1 Assumptions

Several assumptions were made as part of this initial bus integration planning effort:

- The operating characteristics for the TLE project are based on the Conceptual Operations Analysis memorandum produced by HDR, Inc. dated January, 2015. The operating characteristics for the TLE project are considered preliminary and therefore subject to change as refinements are made to the project. Additional detail on the operating characteristics are provided below.
- Alterations to bus route schedules in light of proposed routing pattern changes were not considered at this time. It was assumed that routes would generally follow existing schedules, even though new routing patterns and the introduction of expanded Tacoma Link service would necessitate a review of schedules in the future.
- This memorandum places particular attention on transit services operating within the Stadium District and Hilltop neighborhoods. Bus route modifications in Downtown Tacoma have not been determined. It is generally assumed that each route would follow a similar routing pattern in Downtown as they do today.

2.0 Current Conditions

Bus service in the City of Tacoma is principally radial, meaning that service is focused on Downtown with most routes originating/terminating in the central business district. Some crosstown bus service is available, linking city neighborhoods with radial routes or transit centers that serve as transfer points between local and express bus services and/or other transit modes, such as Sounder Commuter Rail. Local bus routes provide service on major arterials and collector streets along the city's local street

network, with express routes branching out from Downtown along freeway and interstate highway arterials.

Within the Pierce Transit network, a hierarchy of bus routes helps focus service planning and implementation efforts across the city. Three "trunk" routes, Routes 1, 2, and 3, generally provide 15- and 20-minute peak/off-peak service (depending on route) over the course of between 17 and 19 operating hours during weekdays, while other system routes generally provide 30- and 60-minute peak/off-peak service over shorter spans of service. These trunk routes operating at higher levels of service throughout the day enable more expedient connections to Downtown Tacoma, and allow for timed transfers between other routes operating at reduced levels of service given current funding availability.[1]

Two major transit facilities operate within (or near) Downtown Tacoma: the Commerce Street terminal/layover facility and the Tacoma Dome Station. Both facilities are served by the existing Tacoma Link service and Pierce Transit bus routes. The Commerce Street terminal/layover facility primarily serves Pierce Transit routes, while the Tacoma Dome Station offers connections to Sounder Commuter Rail, Tacoma Link, and Sound Transit express bus services, along with Pierce Transit bus routes. Other fixed transit facilities are located within Tacoma, but not within the project's study area. The basic operating characteristics of the local and express bus routes serving the project study area are described in Table 1.

Figure 1 provides a general illustration of the current transit network service in the study area. It should be noted that some routes are overlaid on top of other routes, and therefore not always visible. Refer to the Pierce Transit website[2] for current route pattern information.

Currently, the Stadium and Hilltop neighborhoods are served by twelve Pierce Transit fixed local bus routes and one express route. The radial nature of the current bus network orients two trunk routes through the Hilltop neighborhood, a benefit to residents and institutions located in this region of the city. Overall, both neighborhoods are currently well served by transit as routes converge on Downtown Tacoma. While some routes may operate at 60-minute service frequencies, the combination of two or more routes on arterial streets serving these two neighborhoods subsequently results in shortened headways along segments of arterial corridors in both neighborhoods, therefore providing higher levels of service as compared to other regions of the city. There are no exclusive bus lanes, peak-period bus only lanes, or other visible transit-specific roadway treatments (e.g. BAT lanes, contra-flow lanes) within the project study area.[3]

[1] In recognition of the funding limitations now and in the foreseeable future, any proposed bus network changes should be considered in light of a neutral funding strategy.
[2] Pierce Transit Website: http://www.piercetransit.org/
[3] Intelligent Transportation Systems (ITS) solutions were not investigated at the time of this memorandum's authorship.

Table 1 – Current Service Characteristics of Study Area Bus Routes

Route	Service Type	Weekday Frequency[1]			Service Span
		Peak	Off-Peak	Evening	
1 - 6th Ave - Pacific Ave	Local - Trunk	15	20	60	4:35am - 11:41pm
2 - S. 19th St - Bridgeport Way	Local - Trunk	20	30	60	5:45am - 11:03pm
3 - Lakewood - Tacoma	Local - Trunk	30	30	30/60	5:45am - 10:04pm
11 - Pt. Defiance	Local	60	60	-	6:45am - 6:38pm
13 - N. 30th Street	Local	60	60	-	5:40am - 5:20pm
14 - Proctor District	Local	60	60	-	6:00am - 5:51pm
16 - UPS – TCC	Local	60	60	60	5:45am - 8:11pm
28 - S. 12th Street	Local	30	60	-	6:45am - 8:38pm
41 - Portland Ave	Local	30	30	60	5:10am - 8:14pm
42 - McKinley Ave	Local	60	60	-	6:45am - 7:07pm
45 – Yakima	Local	60	60	-	5:45am - 7:17pm
48 - Sheridan - M Street	Local	30	60	60	5:20am - 9:23pm
53 - University Place	Local	60	60	60	6:15am - 7:59pm
57 - Tacoma Mall	Local	30	30	60	6:15am - 8:20pm
102 - Gig Harbor Express[2]	Express	30/60	-	-	3:05pm - 7:11pm
400 - Puyallup - Downtown Tacoma	Express	30/60	60	60	4:47am - 8:53pm
500 - Federal Way	Express	60	60	60	6:41am - 10:25pm
501 - Milton-Federal Way	Express	60	60/120	60	5:57am - 8:37pm
590/594 - Seattle-Tacoma	Express	5/10/15	30	30	4:10am – 12:56am

Source: Pierce Transit and Sound Transit, 2014

[1] Peak periods are generally defined as 6-9AM and 3-7PM; off-peak periods refer to 9AM-3PM, and evening service is anything after 7PM.

[2] Route 102 provides only afternoon peak period service, according to available schedule information on the Pierce Transit website.

Figure 1
Existing Study Area Transit Network

2.1 Planned Link Operating Characteristics

At the time of this memorandum's writing, the proposed TLE project operating characteristics are as follow:

Table 2 – Proposed Operating Characteristics

Day	Time Period	Frequency (Mins)	Hours of Service	One-Way Trips[1]
Weekdays	5:00 am - 6:36 am	20	1.5	9
	6:36 am - 8:00 pm	10	13.5	162
	8:00 pm - 10:00 pm	20	2	12
Saturday	7:48 am - 10:00 pm	10	14	228
Sunday	9:48 am - 5:45 pm	20	8	48

Source: TLE Conceptual Operations Analysis, January 2015

[1] The number of one-way trips during a designated time period is subject to scheduling optimization

Weekday service is planned to operate for approximately 17 hours, with the majority of service operating at 10 minute frequencies during normal daylight hours and at 20 minutes in the early morning and late evening periods. It is anticipated that trains will experience 30 seconds of dwell time at each streetcar station, with a turnaround time at end-of-line stations of three minutes. Six new stations are planned, and Theater District Station will be relocated from Commerce & 9th to Commerce & 7th (adjacent to Old City Hall). The proposed alignment and station locations are illustrated in Figure 1 above.

Considering the proposed operating characteristics of the Link system relative to the current bus schedule, there are opportunities and challenges to service integration. In spite of the current frequency of service, under the current routing pattern some stations would receive more bus trips than others. For example, Routes 11, 14, and 16 all serve the portion of N 1st Street where the Stadium District Station is proposed. Conversely, the proposed MLK/S 11th station would be served only by Route 28, which operates every 30 minutes during the peak and at 60-minute headways off-peak. This results in fewer bus trips to this station as compared to Stadium District Station. In summary, the current level of bus service offers limited interaction opportunities, even if the routes are currently aligned or adjusted in the future to serve Link stations. Over time, as funding becomes available to improve bus service, this challenge may be abated.

Pierce Transit has provided a set of preliminary comments regarding the integration of existing bus routes with the proposed project that help inform the future transit network service the City of Tacoma. Among these suggestions are that station locations be planned near interlining bus routes. Industry standard for proximity defines two city blocks as the maximum transfer distance. Pierce Transit operates several bus routes that will interline with the proposed project, and submitted the following preliminary comments on service integration:

- MLK/S 19th Station – The Pierce Transit Route 2, with an annual boarding count of approximately 900,000, connects Lakewood and Downtown via Tacoma with Tacoma Community College. Ensuring a close and easy transfer between this route and the planned

extension is critical for successful transit transfers for riders and a healthy multi-modal transit system in Tacoma.

- MLK/S 11th Station – Pierce Transit Route 28 offers 30-minute peak frequency and 60-minute off-peak service from Tacoma Community College to Downtown Tacoma using S. 11th and S. 12th streets. This route operates from 6:40am until 8:30pm.
- MLK/Division Station – Pierce Transit Route 1, the most productive route in the system, serves nearly 1.9 million boardings annually, connecting riders from SR 7 and South 192nd in Spanaway to Tacoma Community College via Parkland, South Tacoma and Downtown Tacoma. Ensuring a close and easy transfer between this route and the planned extension is critical for successful transit transfers for riders and a healthy multi-modal transit system in Tacoma.
- Pierce Transit Route 57, connecting Tacoma Mall Transit Center and Downtown Tacoma via S. 25th Street and MLK Way, provides vital service to the Hilltop community. Because a portion of this route would duplicate the TLE alignment, Pierce Transit plans to evaluate the re-deployment of this service along that portion of the corridor to other parts of the community.
- Other interlining routes that would benefit from a station location in the Stadium Business District include:
    - Route 11 – Downtown Tacoma to Point Defiance Ferry Dock via Proctor District and University of Puget Sound
    - Route 13 – Downtown Tacoma to Proctor District
    - Route 14 – Downtown Tacoma to Proctor District via University of Puget Sound
    - Route 16 –Tacoma Dome Station to Tacoma Community College Via Proctor District
    - Route 102 – Gig Harbor Express running only at Peak Time connecting Purdy, Gig Harbor with Downtown Tacoma and Hilltop
- Connecting local routes and Tacoma Link will be vital, and Pierce Transit may consider re-aligning its routes in the future to better serve the community.

3.0 Conceptual Bus Service Modifications

Implementation of the proposed Tacoma Link system on Stadium Way, Division Avenue, and MLK Way presents the opportunity to consider modifications to the existing bus network to provide complementary service between routes, modes, and travel markets.

The radial east-west nature of bus routes serving Downtown Tacoma and the Commerce Street terminal/layover facility already positions the bus network well to interface with the planned streetcar alignment running parallel to the general north-south alignment of Downtown Tacoma. For example, Pierce Transit's Route 1 provides service between south and west Tacoma via Downtown. This route already connects with existing Tacoma Link stations on Commerce Avenue, but would also connect with the proposed MLK/Division Station. However, given the south and west Tacoma travel markets served, no changes are recommended to this route. Similarly, Route 2 provides east-west aligned service on 19th Street that would directly connect with a proposed MLK/S 19th Station. Where bus routes interact with the planned Tacoma Link network, the service provided between both modes is complementary and not competitive. The following bus route modifications have been proposed to (and are currently under consideration by) Pierce Transit.

- Terminate the Route 102 express bus in either Downtown Tacoma (Commerce Street terminal/layover facility) or at the Tacoma Dome Station (depending on demand), and eliminate the route's service on MLK Way, S. 9th and S. 11th Streets. Data on boardings by stop location provided by Pierce Transit suggest minimal stop level activity where this route serves MLK Way and the hospitals near Division Avenue.
- Re-route the Route 14 bus to serve MLK Way, thereby replacing the service eliminated on Route 102. Eastbound Route 14 would turn southbound from Division Avenue onto MLK Way (issues with turning radii will need to be worked out and possibly addressed during TLE construction), and could provide bus service near the proposed MLK/6th Ave Station (it is the preference of Pierce Transit that buses not serve streetcar stations given the inherent differences in vehicle types). The eastbound Route 14 would then turn east onto S. 9th Street and proceed to the Commerce Street terminal/layover facility. This route could operate westbound on S. 11th Street to provide additional service on this corridor between Downtown Tacoma, the Pierce County Superior Court, and Bates Technical College. This re-alignment would also reduce service duplication on Division Avenue, Broadway, and St. Helens Avenue, which are already served by Routes 11, 13, and 16. Also, by adjusting Route 14 to serve this stretch of MLK Way, the proposed Tacoma Link MLK/6th Ave Station would receive bus service every 60 minutes as compared to the current five peak-period afternoon trips per day provided by the Route 102. A preliminary assessment of the mileage traveled by this route modification suggests that the difference is minimal, but there would be approximately one-quarter mile less than the current routing pattern, thus saving some operating cost. Available data suggest that these three bus routes adequately serve existing demand on Broadway and St. Helens Avenue. The two bus stop pairs currently on MLK Way between S. 6th Avenue and Division Avenue for each side of the street can possibly be reduced to one pair.
- Consideration of re-routing Route 57 presents several options. The revision to this route is intended to minimize duplicative service along the portion of MLK Way that would be served by both the TLE project and Route 57. Ultimately, it is possible that both routes could work within the same corridor, as both transit lines serve different travel markets. However, re-routing Route 57 could disperse transit service across a greater geographic area, enhancing service coverage. Conversely, re-routing Route 57 off of MLK Way could impact roughly 250 average weekday riders. Therefore, a more thorough examination of alternatives should be performed before making a determination on any revised routing pattern. Re-routing Route 57 to serve the Tacoma Dome Station, UW Tacoma, and other lower Downtown activity centers may outweigh the cost of bypassing the core of Hilltop and its hospitals.
    - Option 1: Re-route Route 57 off of MLK Way, instead turning this route eastbound onto S. 15th Street (assuming a northbound approach). Eliminating service on MLK Way could reduce operating costs by eliminating circuitous routing through the Hilltop neighborhood and provide a more expedient trip into Downtown Tacoma. Route 57, remaining on S. J Street, would provide a one-block walk to the proposed TLE MLK/S 19th Station, enabling passengers to transfer between Link and the bus network. The route would continue to serve St. Joseph Hospital, but also provide service to the convention center, and interact with the Tacoma Link Convention Center Station.
    - Option 2: Eliminate the current routing pattern of Route 57 north of S. 25th Street, and run Route 57 on S. 25th Street directly to Tacoma Dome Station. This routing pattern would provide direct access from the region's primary multi-modal facility to the

Tacoma Mall and other parts of Central Tacoma. There are currently no routes serving Central Tacoma and the Hilltop area that directly serve the Tacoma Dome Station Transit Center.

  - Option 3: Run Route 57 on S. 25th Street to one of the major north/south corridors. Possible streets include Yakima Avenue, Tacoma Avenue, Market Street and Pacific Avenue. These routes would serve destinations such as the museums, UW Tacoma, Pierce County Jail and the County-City Building.

- Adjust Route 28 to operate on S. 11th Street only. The current Route 28 is based on a one-way street pattern that no-longer exists. Pierce Transit will consider revising the route to operate in both directions on S. 11th Street and eliminate the existing one-way couplet on S. 11th and S. 13th Streets. This will provide bus riders with access to Route 28 on both sides of the street in both directions. It would also provide better, more reliable connections to the proposed TLE MLK/S 11th Station.

Figure 2 displays the conceptual route alignment modifications discussed above. As noted previously, the exact alignment of these routes in Downtown has not been determined, although it may be assumed that each route will follow a similar routing pattern as they do today.

Figure 2
Conceptual Route Alignment Modifications

Under the proposed routing scheme, all local bus routes would continue to serve the Commerce Street terminal/layover facility, providing a connection to other local and express fixed route services and the current Tacoma Link service. The primary benefit of the proposed routing scenario is that the proposed modifications reduce duplicative service on several streets. In turn, modifying the underlying bus service helps to geographically spread service across a greater coverage area, can improve service frequency along several corridors and at proposed Tacoma Link station locations, and potentially reduce operating costs (or at least keep operating costs neutral to current levels). While it may seem as though providing bus service along MLK Way duplicates the service provided by the Link network, retaining service along this street will help connect points in between stations, such as the Municipal Services Center building and Post Office, while also connecting these points with Downtown.

4.0 Conclusion

Introduction of the TLE project creates several opportunities to re-align existing Pierce Transit bus routes to complement future streetcar service. The modifications presented for consideration herein help to reduce overall operating costs by eliminating duplicative service and unproductive portions of specific routes, but would also provide greater levels of transit service to the study area at no additional operating cost. A routing configuration network as discussed will provide additional transit service coverage and frequency in Downtown Tacoma, and the Stadium District and Hilltop neighborhoods.

It is important to note that the perceived benefits identified are conceptual at the time of this memorandum's writing, and additional bus integration planning and design will be necessary as plans are refined for the TLE project alignment and operating characteristics. It will also be important to test these routing patterns to ensure the Pierce Transit bus fleet can successfully achieve the turns proposed in the new routing patterns, that issues with grade changes are not problematic for bus vehicles, and that transit is compatible with the surrounding urban environment.[4] In downtown, the capacity of the Commerce Street terminal/layover facility must be considered in light of routing patterns on downtown streets to ensure buses time arrivals and transfers successfully with one another. For example, Route 57 might service Pacific Avenue on northbound/inbound trips to downtown, while southbound/outbound trips might use Commerce Street. Fortunately, the alignment of downtown streets enables a variety of routing possibilities to optimize coverage and frequency.

It is important that additional routing pattern changes may and should be considered to further optimize transit service in Tacoma, particularly as additional funding becomes available. Also, as noted, any routing changes must be made in consideration of current travel patterns by riders, as routing modifications can be disruptive to current route ridership. If a proposed adjustment to a route is anticipated to result in adverse affects to route ridership that outweigh potential benefits, then the change should not be made.

[4] The City of Tacoma has initiated a subarea planning effort to develop neighborhood level plans for city neighborhoods including the Hilltop and North Downtown regions. In 2009, the city adopted a "Complete Streets" policy that includes a Transit Priority street typology. MLK Way is identified in both the North Downtown and Hilltop subarea plans as a future transit priority street, along with Division Avenue, two streets planned for streetcar and served by bus routes. Preliminary reviews of these planning documents have suggested that the modifications to transit service proposed herein do not conflict with the mobility elements of these plans.